DOCUMENT RESUME

ED 120 009		SE 020 480

TITLE	Additional Selected Papers from the Annual Conference of the National Association for Environmental Education (4th, New Orleans, Louisiana, April 1975).
INSTITUTION	National Association for Environmental Education, Miami, Fla.
PUB DATE	Apr 75
NOTE	64p.; For a related document, see SE 020 368
EDRS PRICE	MF-$0.83 HC-$3.50 Plus Postage
DESCRIPTORS	*Conference Reports; Energy; *Environment; *Environmental Education; Instructional Materials; Models; *Program Descriptions; Program Development; Publications
IDENTIFIERS	Louisiana (New Orleans); NAEE; National Association for Environmental Education

ABSTRACT

These reports are designed to provide environmental educators with the current issues in the field. Topics discussed in these papers include general environmental concerns such as environmental controls, energy policies, environmental crises and public relations, and effects of offshore drilling on the marine environment. Illustrations for the development of effluent monitoring equipment and laboratories, as well as the design for a two-year technical training program, are included in one of the papers. General environmental education is the concern of the remaining papers. (MA)

ADDITIONAL SELECTED PAPERS

from

the Fourth Annual Conference of

THE NATIONAL ASSOCIATION FOR ENVIRONMENTAL EDUCATION

New Orleans, Louisiana

April, 1975

National Association for
Environmental Education
5940 S. W. 73 Street
Miami, Florida 33143

PREFACE

Due to space limitations, it was not possible to include all papers presented at the Fourth Annual Conference of the National Association for Environmental Education in Current Issues in Environmental Education - 1975: Selected Papers from the Fourth Annual Conference of the National Association for Environmental Education. However, both editor Robert Marlett and the NAEE Board of Directors have indicated that several papers which were not included are of sufficient quality and potential general interest that they deserved opportunity to be circulated. Accordingly, they have been submitted to and accepted by the ERIC Center for Science, Mathematics and Environmental Education for announcement and availability through the ERIC system.

Included in this compilation are:

"Offshore Oil and the Marine Environment," by W. L. Berry, Staff Environmental Specialist, Shell Oil Company, New Orleans, Louisiana;

"Public Relations in the Environmental Crisis," by Jack Harmon, Southwest Research Institute, 8500 Culebra Road, P.O. Box 28510, San Antonio, Texas, 78284;

"Environmental Controls: Their Impact on the Shape and Size of the City," by Peggy A. Lentz, Assistant Professor, Urban Studies Institute, University of New Orleans, New Orleans, Louisiana, 70122;

"Handbook on Environmental Education with Selected Case Studies, by Robert N. Saveland, 203 Dudley Hall, The University of Georgia, Athens, Georgia, 30602;

"The Development of Hardware and Software for an Effluent Monitoring Procedure Program," by Carl M. Schwing and William T. Engel, Charles County Community College, Box 910, Mitchell Road, La Plata, Maryland, 20646;

"Energy Policy," by Toufiq A. Siddiqi, School of Public and Environmental Affairs, Indiana University, Bloomington, Indiana, 47401;

"Environmental Educators," by Carl Thompson, Executive Vice President, Hill and Knowlton, Inc., 633 Third Avenue, New York, New York, 10017.

OFFSHORE OIL AND THE MARINE ENVIRONMENT

by
W. L. Berry

It is both an honor and pleasure to address the Fourth Annual Conference of the National Association for Environmental Education. This afternoon I am going to talk to you about the development of offshore oil and gas resources and the marine environment. Both topics are not only interrelated and timely, but of vital importance to all of us. We need the energy which (is believed) lies off the Outer Continental Shelf areas of the United States. Yet, at the same time, these natural resources must be obtained in a manner which both respects and protects the marine environment. As you are probably aware, there is resistance by many people to development of these offshore resources particularly along the Atlantic Coast and off California and Alaska, the so-called frontier areas. We believe the problem is mainly one of education. What one does not understand, one naturally resists. Therefore, we in industry are presenting our story through various forums such as participation in the conference here. My presentation will take only about 25 minutes, after which I will gladly attempt to answer any questions you might have.

To date most of the drilling for and production of offshore oil and gas has taken place in the Gulf of Mexico, particularly off the coast of Louisiana. There has been limited development in the Santa Barbara Channel area of California and in Alaska. But it is anticipated that large reserves are also located in the frontier areas off the Atlantic Coast - California and Alaska. We, at Shell, and the entire industry believe that not only should development be continued in the Gulf of Mexico, but that the search be extended to the frontier areas. Most importantly, we are confident that this can be done, as it has been in the past, in a manner both compatible with the natural environment and other uses of our nation's oceans.

Today I would like to prove this point to you in the best way I know: By showing you how offshore operations are conducted and by examining our track record. Since most of these activities have been in the waters of offshore Louisiana, I will use our state as a prime example.

The Coastal Region of Louisiana is an area we residents are justifiably proud of. The countryside is uniquely beautiful. We have many good beaches such as Grand Isle and Elmer's Island which are accessible by car. And we have others like Raccoon Point at the western extremity of Isles Derniers which are accessible only by boat, float plane or helicopter. Our state abounds with wildlife such as the American alligator. We also have millions of feathered friends including the white pelican and the brown pelican, our state bird. Salt water sports fishing is excellent. Numerous species are caught. Commercial fishing is a major industry. Prime oyster and shrimp production and harvest areas, among others, are located throughout the entire coastal regime. Most of us feel that Louisiana produces the best oysters in the country - if not in the world. Usually our state leads the nation in shrimp production. Coastal Louisiana is indeed beautiful and rich.

In the midst of all this surface natural beauty and wealth lies another natural wealth hidden underground: oil and gas. These resources which are vital to our nation's very existence have been sought and produced from the coastal and offshore waters of Louisiana since 1927. Nearly 20 percent of the gas and oil currently produced in the United States comes from offshore - mainly from Louisiana. Initial development was in the wetlands. In 1937 the first true offshore well was drilled about 10 miles east of the mouth of Calcasieu Pass, approximately one mile offshore. Activities were accelerated after World War II. Most development offshore Louisiana currently takes place on the Outer Continental Shelf on federal leases administered by the U. S. Department of Interior. Some of these leases are over 100 miles from shore. This is where the action currently is and will be in the future. Therefore, I will concentrate the remainder of my remarks on Outer Continental Shelf activities.

First, at the request of the Department of Interior, interested companies nominate areas or tracts they would like to see put up for leasing. The Department of the Interior then develops and issues a draft environmental statement, as required by the National Environmental Policy Act. Next, after the draft environmental statement is issued, open hearings are held to give the public an opportunity to express its views. And then, if a favorable final environmental statement is issued, a lease sale is held. At that time, petroleum companies bid on leases offered by the federal government.

Companies submit sealed bids to the Interior Department's Bureau of Land Management, indicating how much per acre they will pay to the government on specific tracts. Later, the Bureau of Land Management awards the leases to the successful bidders. The entire procedure from nomination to sale takes about 15 months for completion. It is important to realize that up to this point the successful bidder is not certain if oil or gas is present on the lease. His bid was based purely on surface data mainly from seismic surveys. These can only tell where favorable conditions exist which would likely trap hydrocarbons. Wells must be drilled to determine if hydrocarbons are indeed present in areas which appear to be favorable. This can only be done after the leases are issued. When it is time for such exploratory drilling, a self-contained rig is brought to the site. Various type of rigs costing up to $25,000 a day are used. The selection usually depends on the water depth.

If oil or gas is discovered in the exploration effort, it is common practice to abandon exploratory holes without attempting to complete or produce them. Once sufficient reserves are found, the next order of business is to install a platform to drill wells to produce the oil and gas. In designing a platform, the engineers must consider the forces of winds, waves and currents that are likely to occur during a 100-year storm. The structure consists of two sections. The jacket is installed on the ocean floor and is mostly below water. The deck section is placed on top of the jacket and provides space for all needed equipment. Like an iceberg, only a small portion of the platform is above water. Platform costs are strongly related to the water depth: the deeper the water, the more expensive the structure. A platform for installation in 250 feet of water in the Gulf of Mexico will cost about $5 million and require more than one year for construction.

Once the platform is installed, the drilling rig is placed on the structure to drill the production wells. The number of wells that are drilled and

completed on a single platform will vary depending on the size of the oil and gas accumulation that is present and the design of the platform. Up to 36 wells can be drilled from a single structure using directional drilling techniques. When all the producing wells have been drilled and completed, the drilling rig is removed and production equipment is placed on the structure. If the oil from the platform were to be moved by barge, the system would be complete. However, most oil and gas is moved to shore by pipeline. Therefore, pipelines usually must be installed before commencing production. When the hydrocarbons reach shore, the offshore exploration and production cycle is complete. The oil and gas are moved inland for processing as in Shell's Norco refinery, located on the Mississippi River a few miles upstream of New Orleans. It is important to note that it is not necessary that such facilities be located right on the beach and they rarely are. Ultimately the finished products are transported to market.

Many safety features and anti-pollution devices are used in the offshore drilling and production industry. Some are common industry practice and some are required by regulations. We are regulated by four federal agencies: Department of the Interior, United States Coast Guard, Environmental Protection Agency, and U. S. Army Corps of Engineers. Examples of regulatory requirements are:

1. Aids to Navigation - lights and horns to warn ships;

2. Fire-fighting equipment;

3. Personal safety devices;

4. Blowout preventers on drilling wells (these are valves at the surface that can be closed around anything in the hole to keep it under control);

5. Subsurface safety valves are installed in completed wells; the valves are kept open by hydraulic pressure and close automatically in case of fire or accident;

6. Emergency shutdown stations permit shutting in an entire platform in less than one minute with a single switch or lever; and

7. Sewage treatment plants are installed on all structures where men live.

And the list goes on. Over 500 safety devices will normally be utilized on a platform containing 20 wells.

Yet, despite all these precautions, accidents can and do happen, and industry is prepared to respond to them. For example, a considerable amount of equipment to clean up oil spills is available through an industry cooperative, Clean Gulf Associates. Examples of the devices maintained by Clean Gulf are:

1. Fast response units which provide capability of quickly responding to any oil spill;

2. Shallow water skimmers which are used in bays and calm protected waters close to shore;

3. Automatic propane guns are available to scare birds away from contaminated areas;

4. If birds become oiled, they can be cleaned and rehabilitated using a portable station; and

5. Units to generate polyurethane foam for oil sorption are maintained.

Finally, there is the "HOSS", a high-volume open-sea skimmer. It is a self-contained system with all equipment mounted on a 52-foot by 160-foot barge. The "HOSS" is the most advanced open-sea skimmer system in existence. In a spill situation, it is towed to location by a tug. Two other tugs deploy the oil containment booms, the skimmer is launched and recovery is initiated.

One final point: We are not satisfied to rest on our laurels. We are continually searching for ways to improve the equipment we have and for new and better devices. One example is a new type of open-sea skimmer that we will fabricate which is self-propelled. It will be over 125 feet long by 42 feet wide. Construction should be completed in about a year.

Despite all of this talk of safety devices and means of dealing with oil spills, what does the record show? We are quite proud of our record. Over 19,000 wells have been drilled in the offshore waters of the United States, mainly off Louisiana. Yet in over 27 years of extensive development, there have been only three major pollution incidents. These have resulted in no long-term environmental damage. Let us briefly review each incident.

The first and most publicized major accident was the blowout in Santa Barbara, California, which occurred at Union Oil Company's Platform "A" on January 28, 1969. Widespread contamination of beaches occurred. Temporarily, the beaches were not fit for any type of recreational activity. However, the area soon recovered and business was as good as ever. But what about damage to birds and sea life? A study by Dr. Wheeler North of the California Institute of Technology concluded that the spill was indeed "cause for concern, but not a cause for hysteria". In his report, Dr. North indicated that the channel would remain "as luxurious as it ever was". Another study by the Allan Hancock Foundation of the University of Southern California concluded: "No evidence of permanent damage". On February 10, 1970, fire broke out on Chevron Oil Company's Platform "C" in the Main Pass Block 41 field located in the Gulf of Maxico. A considerable amount of oil was released after the fire was extinguished and while well-capping operations proceeded. According to a government-supported study by Alpine Geophysical Associates: "...There is little or no evidence of any acute biological problems which were precipitated by this oil spill". Shells' Bay Marchand Platform "B" fire started on December 1, 1970. This platform was located only seven miles off the Louisiana coast, where Bayou Lafourche empties into the Gulf. The conclusions concerning environmental damage from Shell's incident are the same as for the other two major spills: no permanent ecological damage.

Most people concur with these conclusions. But what about problem of chronic pollution associated with offshore operations; i.e., small oil spills, oil in produced water, drilling mud and cuttings, etc.? Some contend these are bigger problems than major spills. What is the answer? In an attempt to find out,

81 petroleum and allied industry companies sponsored a two-year $1,500,000 Offshore Ecology Investigation. The purpose of this project was to assess the overall impact of exploration, drilling and production activities in coastal and offshore Louisiana by studying an area with a history of intensive oil field activity. The study was initiated in June 1972 by Gulf Universities Research Consortium, an organization representing 22 southern academic and research institutes. The area selected for the investigation site was Timbalier Bay and the adjacent offshore to a water depth of about 100 feet. The petroleum industry has been active here since the early 1930's. The study area encompassed over 300 square miles. About 150 platforms are in the area seaward of Timbalier and other barrier islands. Since 1964 a number of 50 barrel plus oil spills have occurred in or near the study area. Included is the fire at Shell's Bay Marchand Block 2 field. Twenty-three scientists representing 13 universities and research institutes participated in this program. From June 1972 through January 1974, about one million data points were obtained in the study area. In September 1974, the project planning council released the final consensus report. The major conclusion was "every indication of good ecological health is present".

A considerable amount of other research is also ongoing in the field of the fate and affect of oil in the marine environment. For example, for the past few years, the American Petroleum Institute has sponsored quite an active research program. Time will not permit a review of all of these interesting studies. However, I would like to briefly discuss a few key projects. In recent years there has been widespread concern that marine organisms concentrate petroleum fractions indefinitely. The theory goes on to say that these toxic fractions are then passed up the food chain in such a manner that they pose a threat to the health of human beings. Investigations by Battelle-Northwest Laboratories and Dr. J. W. Anderson at Texas A&M have dispelled this myth. Their test results show that when oil is ingested by marine organisms "the hydrocarbons are released by the organisms in a relatively rapid manner and the so-called food chain concentration simply does not take place". These results have been supported in a recent report of the prestigious National Academy of Sciences titled "Petroleum in the Marine Environment". The National Academy of Sciences report concludes: "There is no evidence however for food web magnification of petroleum hydrocarbons in marine organisms;" and, "...the effect of oil contamination on human health appears not to be cause for alarm".

In summary, we have reviewed offshore oil and gas operations conducted in Louisiana and have seen that the scientific data support what we residents can all observe. Number one, there is minimal effect on the marine environment and Number two, these activities are compatible with other uses of the offshore. In over 27 years, more than 19,000 offshore wells have been drilled in the United States. Yet no permanent damage has resulted from the three major spills - two of which occurred in the gulf of Mexico. Concerning routine operations, the Gulf Universities Research Consortium Offshore Ecology Investigation showed good ecological health in a Gulf of Mexico area of intensive activity since the early 1930's. This comprehensive field study has been substantiated by research funded by the American Petroleum Institute and the results of a National Academy of Sciences study. The same type of safe and environmentally sound operations will be conducted as the search for new sources of oil and gas is extended to the offshore regions of the Atlantic Coast, California, and Alaska. We are confident the record will also be similar. I hope that if any of you environmental educators did not agree with me before this presentation, you do now.

One final evidence of compatibility of oil operations with the marine environment:

The offshore exploration and production industry actually enhances what has become a popular past time on the Gulf Coast - salt water sports fishing. Structures which support our operations also serve as artificial reefs which, in turn, support colonies of fish. Entire ecological communities operate in the shadows of platforms. New species are constantly appearing. Of course, the real proof of the pudding (or the seafood) is in the eating. I assume all of you are enjoying the delicacies from the Gulf of Mexico during your stay with us.

PUBLIC RELATIONS IN THE ENVIRONMENTAL CRISIS

by
Jack Harmon
Public Relations Director
Southwest Research Institute

If someone, one hundred years ago, had chronicled just a few of the technological achievements which man has made, he would have been describing a utopia. If he had chronicled all of them in his forecasts of one hundred years ago, people would have said he let his foolish imagination carry him beyond the realms of possibility or probability.

We have achieved more than anyone imagined. And yet, when we look about our utopia, we see unhappy faces; we hear complaints; we feel harsh criticism.

This is disturbing to us in the research business. We, especially those of us in the non-profit research centers, did not see it this way.

It was not supposed to be like this at all. We had already accomplished incredible feats. We had seen several human killers eliminated and many others weakened. We had improved man's ability to communicate and had provided him with the means to develop information on a host of matters to communicate about. We had even developed methods and machines so he could better understand himself and his whole universe. We had offered him an insight into what we, at this time, believe to be the very primal elements of life.

And yet, man is not happy. He does not thank science and technology. He fusses at the world he is in, and he blames them for its conditions. The road to the new utopia has proved too steep for him, and he wants to go back to a primitive state of natural grace.

The present situation poses a substantial problem to communicators. It is obvious that many people do not believe that science and technology can affect the environment other than in a negative way. The problem cannot be solved by just telling them, "it ain't so". Perhaps we can find some motivational clues from myths. We all agree, I think, that man has up until now been hoping for a utopia. He has always had these dreams, the concepts of perfect worlds which placed him above the cares of this world and out of the reach of old age and death.

Cuneiform tablets, scratched out 2,000 years before Homer's heroes, tell how one Gilgamesh, King of Uruk in Mesopotamia, travelled to the "land of crossing... the place where the sun rises". This land, called Dilmun, is further described in a Babylonian tablet as a land in which "the raven utters no cries...the lion kills not...the wolf snatches not the lamb...the sick-eyed says, 'I am not sick-eyed'...the sick-headed (says) not 'I am sick-headed'...its old woman (says) not 'I am an old woman'...its old man (says) not 'I am an old man!...' Sickness, sorrow, and old age have been banished from this place of celestial splendor.

This goal of a heavenly paradise, unreachable in this life, runs through all national literatures and religions. It finds its counterpart in Plat's Republic which, through the dialectic, fashions a state which is one with the law, but is beyond the reach of man's faculties.

It was also an unattainable state with Thomas More, who fashioned the word "utopia" from the Greek roots of "no" and "place". This heaven on earth did not exist.

In The New Atlantis in 1627, Sir Francis Bacon had good news for mankind. He made the revolutionary statement that man could create his own utopia through science and technology. He did not have to wait for the afterlife to get to never-never-land. God had given man reason, and from that base he could build a heaven here on earth.

As we approach our Bicentennial Year, it is well that we appreciate the fact that the United States was founded on such a belief that through scientific knowledge man could build a better world. Jefferson and Franklin were great exponents of the moving faith that man could shape the physical and social world to his wishes. To help accomplish this, in 1743, Franklin set up the American Philosophical Society "for the promotion of useful knowledge".

We have moved well toward the goals set by our Founding Fathers. In less than the thousand years which Franklin set as the time limit in a letter to his friend, Joseph Priestly, we have far surpassed his dreams of overcoming gravity and being able to fly "for the sake of easy transport". Agriculture has far exceeded his hopes. Agriculture has greatly diminished its labor and more than doubled its produce. In the health field, we have approached but not achieved the goals he set in saying, "All diseases may by sure means be prevented or cured, not excepting even that of old age, our lives lengthened at pleasure, even beyond the antediluvian standard".

We've come that far/close to the goals set for a utopia on earth. And yet, there are those who are not willing to go any further; who, through either confusion, despair or mistrust of a rational approach, have abandoned the quest for surroundings and a way of life conducive to happiness. In a world which has labelled itself cybernetic, they are adrift without a compass.

We have been reduced to two vocal and powerful groups of opposite polarity.

The first of these we can call the children of Gilgamesh or Theodore Reich. These people believe that a state of primal innocence can and should be established on earth. With Rousseau-like simplicity, they see man and animal as naturally charitable and knowing until corrupted by what we call civilization. The only machine these people care about is the clock, and they want to turn back.

On the opposite pole are the adamant advocates of science and technology who will do anything for justification, even if it means perverting the truth of science and technology. We recognize the fact that a man or woman who makes a discovery or plays an important role in a scientific or technological area would have a vested interest in its progress and be partisan in its advancement. However, he should restrain these leanings before they cause him to close his mind or adopt absurd claims in its exploitation. Pressures on the scientist can explain his actions but not excuse them. The extent to which some of our scientists and technologists are forced to go to defend their work is embarrassing. It was a pitiful spectacle when a distinguished scientist, testifying in favor of funds for atomic energy research, was reduced to inventing the possible development of a robot maid who would make things easier for the voter housewife. Such nonsense does not help science and technology. It only hurts, and badly. The same is true of those who see all of science

and technology as infallible means to man's creation of the utopia on earth.

The extremes are not as many in number as they are loud of voice. The mass of people in the middle are confused, and not knowing where to turn rationally, have turned instinctively against that science and technology which failed to give them the perfect world that some claimed it would.

What can we do about it?

I think we can quickly dismiss those who would have us all return to the primitive state of man. We wouldn't want to go back even if we could. Today, diptheria, childbed fever, polio, and smallpox have meaning only in painful memories. And I do not think even the most dedicated partisans of the simple life would sacrifice the technologically-developed television programs in which they frequently appear as experts or the mass produced books which give wide dissemination to their nonsense.

The group that makes claims too broad, claims that can never be justified, defenses which hold no water, exaggerations when simple explanations are sufficient; this is a group we can do something about.

As a result of Sputnik, science and technology gained in recognition. The time of the realization of the goals of Bacon and Franklin seemed upon us, and it was fashionable to relate any desire for public acceptance and public funds to the progress of science and technology - both of which would soon bring utopia to man. The many accomplishments of science and technology led some to claim they could accomplish the impossible - and accomplish it overnight.

We must be aware of the limitations of science and technology.

We must adopt a program of technological realism.

We should believe in the principle of the utopia of Bacon and Franklin, but we should not be deluded into imagining that we will arrive there in a phaser-teletransported shimmering instant. And just because science and technology cannot solve everything at once, we shouldn't abandon them.

I am happy to say that many people are moving toward the middle from these polarities. I have just come from an international meeting of engineers on quality assurance for nuclear power plants. There has been a change since last year. The engineers, who are crusaders for nuclear power, displayed a moderation of their views. Before, they saw environmentalists as enemies spelled with a capital E. At this meeting they made distinctions between reasonable and unreasonable interveners. The engineers told me the change came because the environmentalists now sought technical advice and did not operate from prejudices. I think this goes for the engineers as well.

Yet, what is reassuring is that two groups who formerly spoke to each other only in shouts and insults were now seeking to work out problems within the framework of technological realism.

Selling such a program is difficult. It is usually necessary to do it many times, repeating the main principles and adapting them to meet the unique features of local situations.

Some opponents of nuclear energy have no such built-in restrictions. Their main commodity is fear. And fear can be spread in a generalized manner. You can set up such a campaign easily on a national or international scale. And it is even likely that you can persuade the FCC to get you free air time to spread your fear campaign. You do not need hard facts.

All you need is a movie star like Robert Redford to give you a celebrity quote. He said, "Frankly, the thought of proliferating nuclear power plants frightens the hell out of me".

Frankly, relying on the scientific advice of Robert Redford frightens the hell out of me.

But I am confident that we can quell these fears even though it is difficult and takes time. Reason can eventually break through. People can be shown that their fears are not justified.

But there is still another way of exciting fears, and that is by introducing wild-haired scientific ideas which not only scare the timid Robert Redfords, but even frighten you and me. I am referring here to such statements as the odd-ball suggestion that we get rid of nuclear waste by shooting it out into space. This was an unfortunate statement, and it was doubly unfortunate because it got so much publicity.

As you will see from the talk by Jim Fowler, we have grown expert in utilizing what we called waste a few years ago. The tailings which piled high as monuments to our profligate conquest of the West are now an important raw material, as are many other products which we used to throw away. It is probably that technology will be able to do the same thing with what we now call atomic wastes. There is little reason to believe that this cannot be accomplished far ahead of the 1000 years lifetime of such waste. Some have suggested that they be stored in impervious salt domes where they can be inspected for possible leaks until we know how to use them. These are the same salt domes which have been marked for storage of large petroleum reserves as insurance against another Arab boycott. There is plenty of room there.

In addition, some of the fears about atomic energy had been allayed by factual demonstrations, distinguishing between the configurations necessary for a bomb and the different setup used to develop electricity through controlled nuclear fission.

Then came the bombshell.

The U. S. Energy Research and Development Administration announced it had received for consideration a suggestion that low cost electrical power could be created by two hydrogen bomb blasts a day in Texas and Louisiana salt domes.

After the initial announcements had shaken the Gulf States, governmental officials chided the outraged opponents for what they called "premature reactions" and then said it would take a still-to-be-funded three-year program of research using chemical explosives to determine even if the idea is feasible. Should this prove successful, it would require a nine-year study before they could build a prototype plant. In addition, the government officials admitted they were not really certain that the bombs could produce electricity cheaper than controlled nuclear fission.

This kind of premature release of highly speculative, sensational hypotheses hurts science and technology and forces the creation of Harmon's variation of Gresham's Law: Bad scientific and technological proposals drive out the good. When sensational means (claiming even <u>more</u> sensational results) gain credence, it is increasingly difficult for those of us suggesting sound research to be heard and funded.

The magic solution is a good example. This is an instant utopia pill which we can pop quickly. It promises to end all the pain and suffering of the energy crisis and environmental growing pains.

Nobody proposes that government agencies shut their eyes and ears to new concepts and devices, but I do not think that open-mindedness requires they waste their energy on ideas and inventions which are invalid at first glance.

This promotion of the magical solution leads people to false hopes which are soon shattered. As a result, science and technology get the blame instead of government officials and the misled press.

One case in point is the LaForce engine. Mr. Sawhill, a former Federal Energy Administrator, was exuberant over the engine's potential contribution, as were some Senators who sought EPA endorsement for it, despite what they and the inventors felt was resistance from the big automotive companies. (I think we should explode this myth right here. The big automobile companies are as anxious, or more so than anyone else, to get any development which can give them a competitive position. Although it still persists and rises up all the time, there is no truth to the fact that big business has suppressed the 100 mpg carburetor, nor is it true that big business has bought up the rights to the eternal light bulb or the wearless tire.) From the sparse details given by the government and the press, research engineers could safely predict that the LaForce engine was not the breakthrough the inventors and the administrator thought it was and that there was insufficient data to back up the environmental claims made for its performance. This was certified by the EPA tests although the einventors were not satisfied.

These magical solutions are something again. You probably cannot stop such stories as this one (visual exhibit): The headline reads, "The World's First No-fuel Engine".

As long as there are tabloids in the grocery store, you can expect junk like that. But do not ever think such stores are restricted to the <u>Tattler</u>, <u>The National Enquirer</u>, and <u>The National Star</u>. You can find them in the respected editorial columns of your daily newspaper.

There's an old chestnut which comes around every so often. It's the "change water into gasoline" caper.

A recent victim was nationally syndicated columnist Kevin Phillips. Phillips seriously recounting a tale of high governmental blundering in World War I, without which we could have prevent the energy shortage, wrote:

> "Imagine a few drops of a gray-green fluid that can turn fresh or salt water into the equivalent of gasoline. Such a chemical would change the balance of world power. Our national energy crisis would be diminished; the threat of a Middle Eastern stranglehold on Western fuel would be scotched; and the gnomes of Araby would cease accumulating

credits to speculate against the dollar. In today's world a discovery of this sort would represent greater alchemy than a medieval success in turning lead into gold."

"The joke is that it may not be a fairy tale; the find may have occurred and been lost. Just such a demonstration was made for the Navy 57 years ago, and before the Navy could secure the formula with an offer of $2 million, the inventory had disappeared!"

This was a great story. It had an Horatio Alger twist, an unlettered foreign inventory (one fearful of the opposition from big business), and a devoted government official who believed in him but was not able to prevail against Naval bureaucracy. It had all the elements but one: It just wasn't true.

But this is not the only one. Here is another example. Ten years ago, Southwest Research Institute did a research project for the State of Nebraska to determine whether alcohol could be used as a fuel in automotive engines. The reason for this was that Nebraska wanted to use its corn surplus to make the alcohol. We found it could work and when the surplus of corn turned into a shortage, there was little interest in pursuing the subject.

But just lately, alcohol has been rediscovered as a fuel by a national news service which gives us this stirring account from France:

"In a dusty corner of his small Citroen auto repair shop, Jean Chambrin, smiling and vonfident, pours tap water and ordinary bottles of ethyl alcohol into a plastic container. He sets the container on a shelf with a tube leading to an old olive-green Army Dodge 44 motor. In addition to its six sparkplugs, a special electronic 'black box' with three more plugs is connected. Chambrin turns the key. An assistant in blue work coveralls pushes the starter. The motor catches and runs smoothly for half an hour. The light smell of alcohol hangs in the air; the exhaust is clean against a white paper."

I want to pause here and make sure you have taken note of this quick, inexpensive way to determine particulates. All you need is a clean white paper. But to continue...

"This is my baby," Chambrin says, brushing off offers from American, German, and other would-be partners..."When it gets hot, I can make the motor go with 90 percent water and 10 percent alcohol," he said in an interview. "Three of my mechanics have a way of making it run on 100 percent water."

This brings to mind the manure cars. These articles recur in cycles, and we know they can work. There are problems of design and size, economy and corrosion, but from the amount of promotional material put out, I do not think we could anticipate a fuel shortage.

But probably the most disturbing story was the recent one of Jerry "or" or "and" Liz Michael and the three-wheeled Dale car. A later very red-faced Fourth Estate was overwhelmed by the women's lib angle, which added fuel to the touted economic and environmental advantages of what was described as a vehicle of revolutionary materials and performance. But then someone looked under the bonnet of the car and found everything wasn't what it was said to be, and then looked under the bonnet of the lady promoter and found a similar discrepancy.

At least for a while, the press had learned a lesson. It has vowed that it will remember there are no royal roads to technology. We hope the bilked investors have learned the same lesson, and we also hope this unfortunate experience will not make them so wary they will hesitate to support developments which are produced with solid research backing.

Research into developments for a complex technological society requires expensive facilities and the time of expensive people. The first automobile could have come from a back room, but any developments for the assembly line technical society will have to come from a much more scientifically developed atmosphere. I am not one to write letters to public officials, but I attended a recent briefing by the Federal Energy Administrator in which he said he was optimistic about energy savings because he said many imaginative people were working in their basements to develop gadgets which could free us from the energy crunch.

I wrote, "I am all for liberation. I want to see the woman out of the kitchen and the homosexual out of the closet. But I want to keep the amateur inventor locked securely in the cellar. Putting your faith in a relatively untrained individual to accomplish tasks in a highly technical environment is no way to contribute to solving the energy shortage, nor is the premature announcement of new systems which can effect savings."

"This was done in the case of the announcement of microprocessors, miniature electronic devices designed to cut fuel consumption drastically. It caused RCA stock to rise about three points, and it is impossible to say how far back it pushed the gasoline conservation program. Best estimates are microprocessors will be in use in two years if very important problems with special sensors are solved in the meantime. Until then we still have to save gasoline."

These are only some examples of how bad information can drown out good information and lessen the salability of valid research.

I think it is our duty as research people and your duty as educators to do something to cut off this flow of bad information.

We have set up such a program on a small scale. We have made it known to local and other reporters that we are available for nonattributed consultations on research stories to assist in determining the truth of claims or the validity of suggestions.

As a guide, we have prepared this set of questions which we feel may be a key to measuring a story. These are, what we say, guides to being suspicious of a scientific or technological idea or development.

1. If it is "cure" in its approach and promises an immediate miracle.

2. If it originates with an untrained person in a picturesque and primitive locale.

3. If it repeals one or more long established scientific laws.

4. If it is eagerly sought by foreign nationals but is being offered for one last time (as a patriotic duty) to American investors.

5. If it is being held back by a conspiracy.

6. If claims are made of presentations at scientific meetings but no research papers are available.

7. If there is no prototype working model.

8. If certain parts of the scheme or apparatus must remain secret.

You can probably add other criteria of your own for causing the press or individuals to view with caution or suspicion.

You can help the press in your area with these problems. It is not easy and no one wants to turn out to be the guy who refused to cover the invention of the light bulb. But the odds are overwhelmingly against it. I urge you to help set up a climate of technological realism.

If we can clear the air of these misconceptions and misstatements, research can work toward a utopia. It is all a matter of cleaning up the informational environment.

Project I-C-E (Instructional-Curriculum-Environment)

All teachers are encourage to incorporate environmental concerns as a natural part of all grades and all subjects by Project I-C-E. As a regional effort with an audience of 53 public school districts and 122 non-public schools, I-C-E involves 7,500 teachers, 165,000 students and the community through the following activities: environmental education guides for all K-12 subjects; an environmental resource materials center of films, filmstrips, simulation games, kits, records and tapes to teachers, business community or social groups in the area; consultation services and identification of community resources by project staff; training and outdoor workshops for teachers; suggestions for the improvement of teaching and curriculum planning; university or college programs for student teachers, interns or methods classes; a monthly newsletter. In approaching curriculum innovation, I-C-E recommends the use of episodes (miniature lesson plans). The episodes can be modified by the teacher in accordance with his ecological training or experience, the type and scope of curricular improvement being sought and the local situation. All curriculum guides were tested and revised as needed. The project calls for total involvement of the community in its activities, and the services of an environmental education specialist to all schools.

ENVIRONMENTAL CONTROLS: THEIR IMPACT ON THE SHAPE AND SIZE OF THE CITY

by
Peggy A. Lentz
Assistant Professor
Urban Studies Institute
University of New Orleans

Introduction

It is vogue to attribute urban environmental problems to Western technology and growth. However, feasible responses are nct so easily determined. Decision-making normally implies a set of behavioral responses to the given problem. In the case of urban environmental problems, the response has often been either a lack of recognition or a conscious decision to do nothing. With some reluctance, private and public sectors in cities have only recently begun to recognize the environmental consequences of urban growth and development. An example which this paper will address is concerned with the impact of materials shortages (especially land and energy) on cities.

The question is what kinds of responses or controls - technical, ecological, political, economic, etc. - are appropriate actions to implement. Technically, the phrase "environmental controls" includes any public or private actions that have a reasonably direct impact on the natural environment or on the human use of it. Such controls, as local, regional and national levels, can be categorized as (1) research and evaluation, e.g., forecasting and futureology; (2) public participation, e.g., citizen groups and public interest science; and (3) governmental actions, e.g., regulatory agencies and the courts.

Americans are generally ill-informed about the types of controls applicable to environmental problems. Also, we are unsophisticated in our choice of decision-making levels. One feasible method for analyzing the effects of environmental controls, without actually implementing experimental policies, is to consider what other countries have done when faced with similar problems.

Using the above example of material shortages, any number of suitable international examples can be cited. Most European nations have struggled during the 20th century with problems related to limited natural resources, especially land and energy. Planning is required in European countries; the choice of policies only varies by degree from England to Russia.

Polish Planning Policies

The example of European planning best known to me is Polish urban policies and practices. The following is a partial list of Polish physical planning practices that differ from American planning.

1. The national government makes the final determinations on all economic and physical planning.

2. Every square meter of Poland must be included in a plan. Very few deviations from official plans are allowed.

3. Citizen participation in the planning process is mandatory.

4. The average Polish citizen is actively involved in historic preservation and renewal. The environmental amenities movement is quite strong.

5. Development rights to property belong to the public at large. Considerable private ownership of land, both urban and rural, does exist but is strictly regulated.

6. Poland has a sizeable bureaucracy of planning technocrats. These are highly trained individuals whose specialties range from architecture and landscape design to economics, sociology, and social welfare.

A striking example of the above six points was the reconstruction of Warsaw's Old Town. During World War II the area was purposefully and thoroughly demolished. One of the earliest decisions made by the new socialist government was to completely reconstruct Old Town. This decision was based on a set of unique criteria. First, the reconstruction provided a symbol of national recovery and unification, which was supported by individuals as well as government. Second, it was a source of housing in a city desperately in need of housing: 85 percent of the city's property was destroyed, and yet, Warsaw's population tripled between 1945 and 1946 from 160,000 to 486,000. Third, the painstaking rebuilding provided on the ground level a pleasant area of shops, squares, cafes, etc., similar to the French Quarter of New Orleans. Old Town rapidly became a viable attraction drawing swarms of American tourists and money.

Thus, planning in Poland after 1945 was an imperative. War destruction was widespread in urban and rural areas. Additionally, the predominantly rural peasant economy made it extremely difficult to provide for basic human needs plus economic recovery.

Land Use Policy and Materials Shortages

Land in Poland is considered a valuable natural resource. Thus, strict controls regulate the allocation of land and location to the potential users. The relative scarcity of land in Poland may be demonstrated by a few comparisons between the American and Polish situations. In 1965 Poland had 33 million people - 16 percent of the United States population - living on approximately three percent of the United States' land area. Or equivalently, the average national population density in Poland is 270 people per square mile compared to a U. S. A. density of 55 per square mile. Also, only 55 percent of the Polish population lives in urban areas; 75 to 80 percent of the American populace is urban. With this limited land resource, Poland manages to produce 80 to 90 percent of its total food needs on one half the number of arable acres per person (1.2 vs 2.4) available in the United States [3].

The intensity of use for any resource indicates its relative value. In terms of urban development, the frugality of land use implies the relative scarcity of land and of other resources used in its development and maintenance. Population density is one commonly used measure of intensity.

In the above discussion it has been shown that on a national basis land in Poland

is intensely used. A similar analysis can be provided for urban areas. In Table 1, population densities for Warsaw, Poland, and four American cities are given. The American cities show persistent patterns of population density decline due to declining central populations, and a concurrent increase in land used for urban purposes. In contrast, Warsaw has had an increasing central population and a stable amount of urban land area.

Obviously, people are not evenly distributed throughout a city area. It has been shown consistently that the distribution of population is positively related to the valuation placed on land [4]. The value of any piece of land can be directly related to development costs, transportation-locational costs, and amenities. Generally, urban population density declines with distance from the city center in a manner similar to Figure 1. This relationship has been demonstrated for cities worldwide and over time since the 1800's [1,2].

Figures 2 and 3 show the empirically derived relationships between population density and distance in Chicago and Warsaw in 1960. Although population density is expressed somewhat differently on the two graphs, it can be seen that both had similar central densities of about 50,000 people. Table 1 indicates, however, that Chicago's SMSA population was more than three times larger than Warsaw's. The differences in the cities' population distributions are due to the much larger land area occupied by Chicago. This produces a relatively unconcentrated distribution. Approximately, 70 percent of Warsaw's population is located within eight miles of the city center compared to approximately 50 percent of Chicago's population.

The scattered structure of American cities can be attributed to many causes, but mainly to the cheap, large-scale mass individual transportation of the 1950's and 1960's (i.e., the automobile, cheap energy supplies, and a seemingly endless supply of land for urban sprawl). In contrast, Warsaw has had very constrained growth conditions. Sufficient transportation was only possible on a mass public basis and land is a scarce, valuable resource.

In effect, Polish urban planning policy has meant careful allocation of resources. Sprawling urban development, American-style, was neither feasible nor desirable, considering the circumstances. Polish cities have well-defined perimeters rather than dribbling out through lower and lower density suburbs into an exurbian situation.

American City Futures

The relevance of this brief comparison between Warsaw and American cities is due to the obvious development of materials shortages in the 1970's in the United States, particularly energy. The demand of automobiles on our energy resources is not the only problem with sprawl. Diffuse development means losing economies of scale in the provision of urban services. That is, more facilities must be built to accommodate a far-fling populace than a concentrate group. Otherwise, people must travel long distances to centralized facilities or even do without services such as sewerage.

Assuming the highly probable continuance of energy shortages and an increasing demand for land in agricultural uses, how do we provide for 60 million more Americans by 2000 A.D.? There is no panacea. But there are a number of feasible policies already suggested and occasionally implemented -- and not all of them are governmental responses.

The effective recycling of our central cities will be critical. Already, this is happening through individual initiative with the return of middle class whites to some inner neighborhoods in cities such as New Orleans, Boston, Washington, Pittsburgh and New York.

Concurrently, we cannot afford to dispose of a sizeable national investment in the existing suburbs. Certain suburban trends could be encouraged, such as the use of a few commercial-industrial-service areas usually centered on a main highway and surrounded by high-density multi-family housing. Properly planned, multi-family housing units can have most of the attractions of single family houses while utilizing less resources. Besides, the high cost of a single family house is going beyond the means of average families.

Finally, the abortive federal program for new communities deserves some re-thinking and serious development. New towns could be built as satellites of existing American cities to take advantage of facilities such as interstate highways and public universities. These new communities would be independent in terms of common urban facilities, yet benefit from the proximity to established centers. Our current urban facilities cannot support the projected population increase, so we must recognize the need for some sort of further urban development. Careful consideration now can produce efficient and humane urban environments.

TABLE I -- A Comparison of Population, Land Area, and Density[a]

City and Year	Central City			Urbanized Area			SMSA[e]		
	Population[b]	Area[c]	Density[d]	Population	Area	Density	Population	Area	Density
Boston									
1950	801.4	47.8	16.8	2233.5	344.8	6.5	2370.0	770.0	3.1
1960	697.2	46.0	15.2	2413.2	514.0	4.7	2595.5	969.0	2.7
1970	641.1	46.0	13.9	2652.6	664.4	4.0	2753.7	1043.0	2.8
Chicago									
1950	3621.0	207.5	17.5	4920.1	707.6	7.0	5177.9	3617	1.5
1960	3550.4	224.2	15.8	5959.2	959.8	6.2	6220.9	3714	1.7
1970	3367.0	222.6	15.1	6714.6	1277.2	5.3	6978.9	3719	1.9
St. Louis									
1950	856.8	61.0	14.0	1400.0	227.8	6.1	1681.3	2520.0	0.7
1960	750.0	61.2	12.3	1662.7	323.4	5.2	2104.7	3187.0	0.6
1970	622.2	61.2	10.2	1882.9	460.6	4.1	2363.0	4119.0	0.6
Washington, D. C.									
1950	802.2	61.4	13.1	1287.3	178.4	7.2	1464.1	1485.0	1.0
1960	764.0	61.4	12.4	1808.4	340.7	5.3	2076.6	1485.0	1.3
1970	756.5	61.4	12.3	2481.5	494.5	5.0	2861.1	2353.0	1.2
Warsaw[f]									
1950	-----	-----	-----	822.0	174.0	4.2	1298.0	1659.0	0.8
1960	904.8	49.9	18.1	1136.0	174.0	6.5	1763.3	1659.0	1.0
1970	1059.9	49.9	21.2	1308.9	174.0	7.7	1997.5	1659.0	1.2

[a]Sources: U.S. Bureau of the Census, Eighteenth Decennial Census of the United States: 1960, Population, Vol. I, Tables 22 and 34; __________, Census of Population: U70. Number of Inhabitants, Final Report PC (1) - A1 U.S. Summary, Tables 20, 32, and Warsaw, Warsaw Town Planning Office, data sheets.

[b]Population figures are in thousands.

[c]Area is in square miles.

[d]Density is in thousands per square mile.

[e]Data for the American Cities in 1950 were given by the census for Standard Metropolitan Area, which had only a slightly different definition.

[f]The pre-1951 boundary of Warsaw has been used to define "central city." The post-1957 boundary has been used to define "urbanized area." The Warsaw conurbation (Warsaw and the five poviats immediately surrounding the city) has been used to define an equivalent unit to an American SMSA. Data were not available for Warsaw central city in 1950.

Figure 1. -- A Model for Urban Population Density

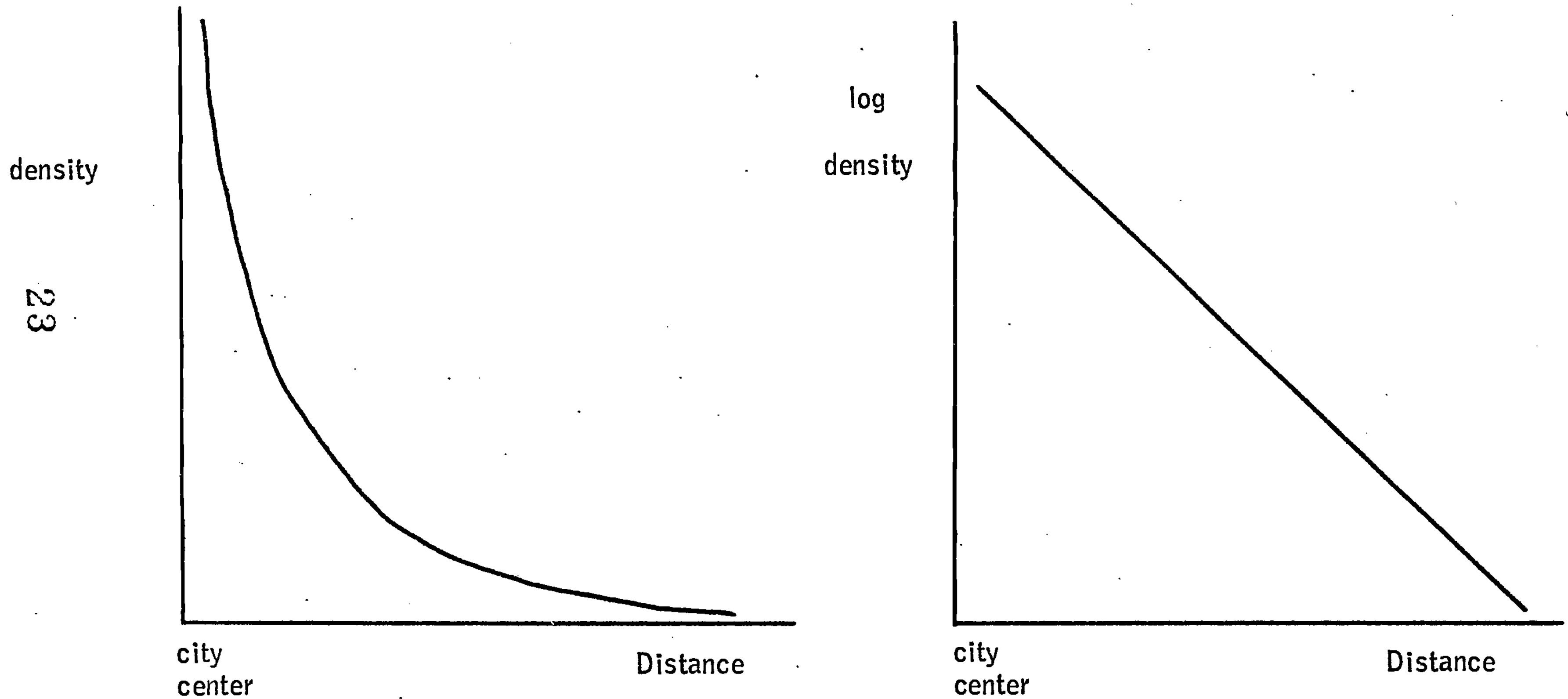
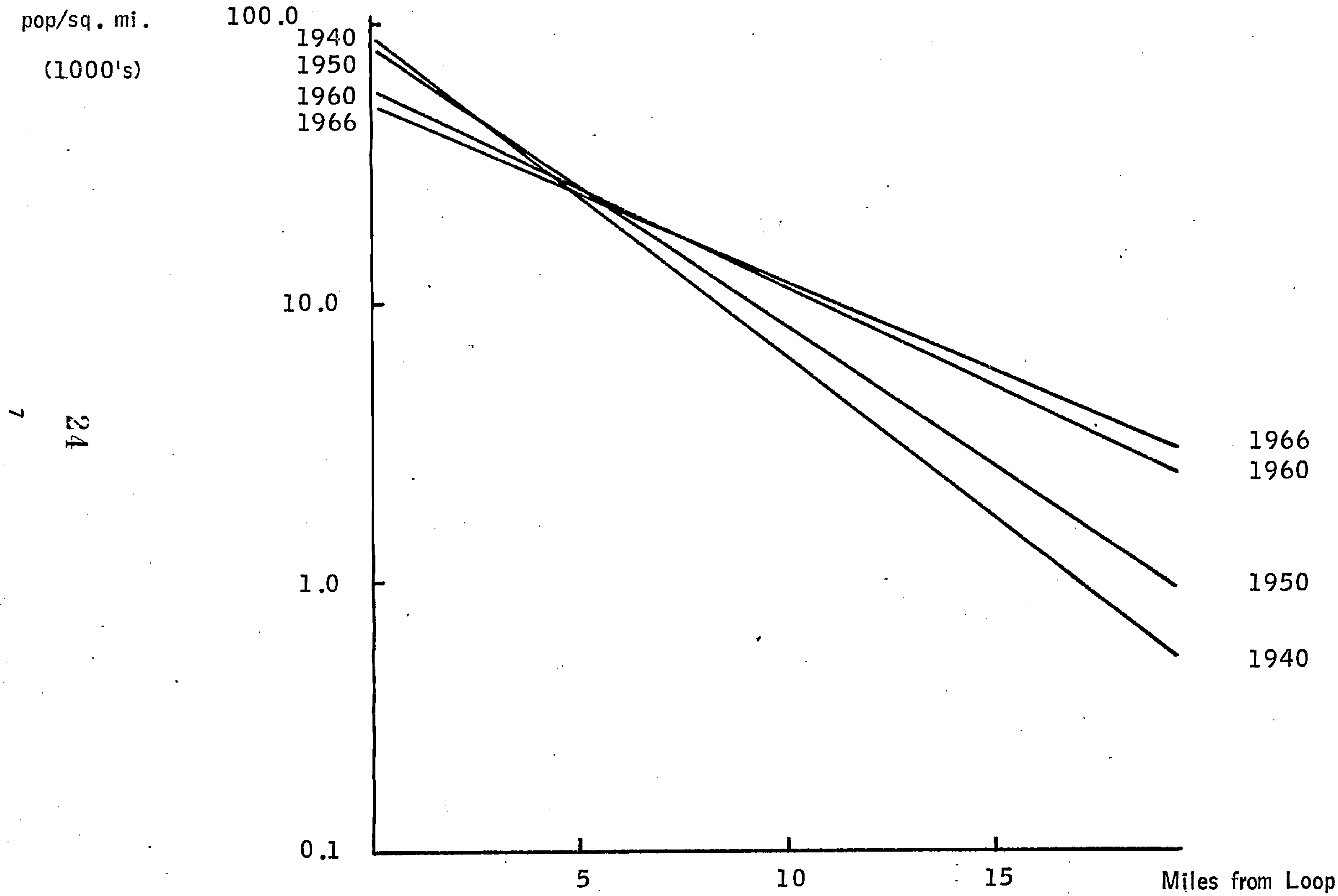
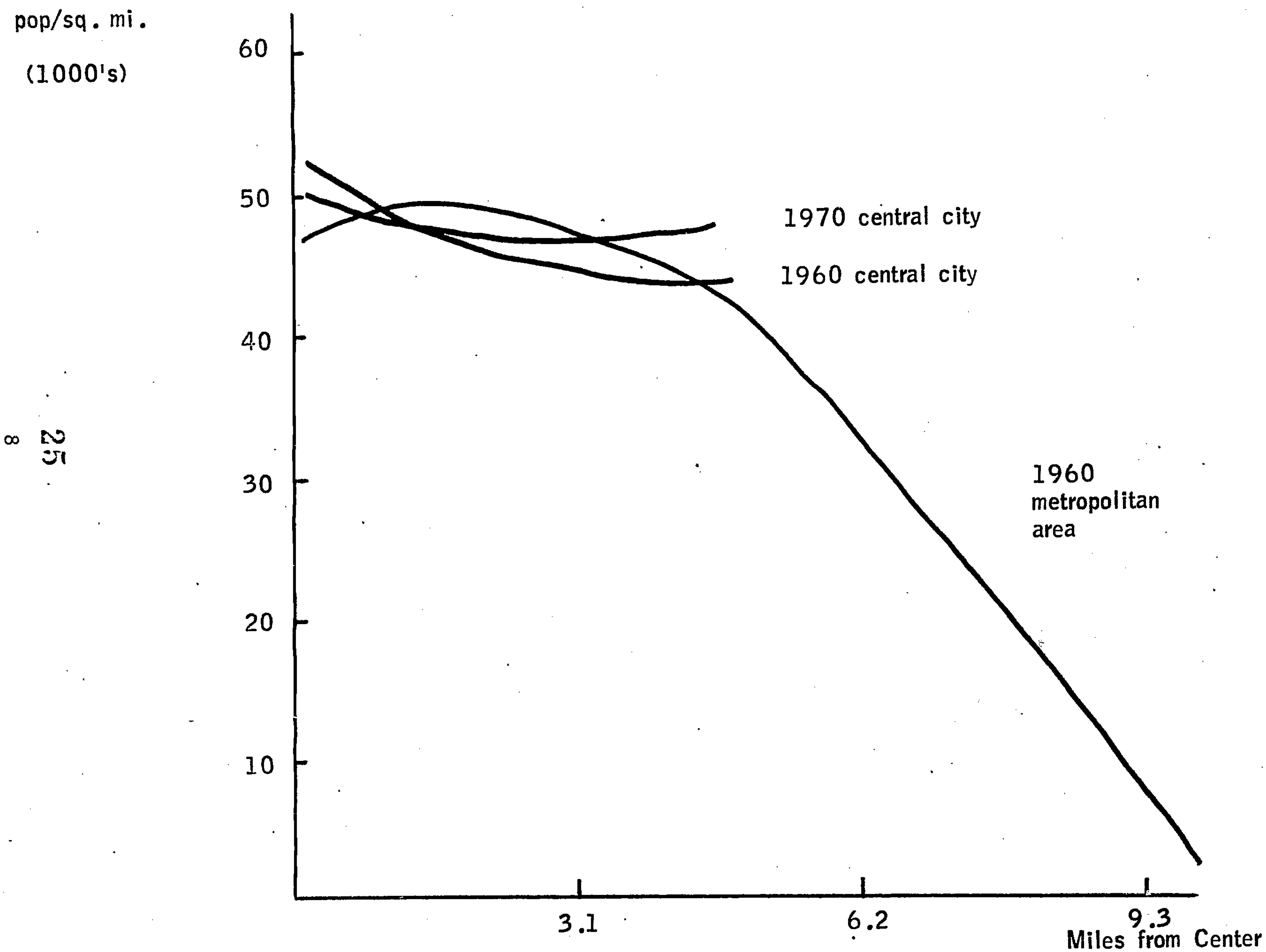


Figure 2. -- Population Densities in Chicago



Source: CATS, 1959. Final Report. Vol. I: Survey Findings. Chicago: Western Engraving & Embossing Co.

Figure 3. -- Population Densities in Warsaw



Source: Private Data.

References

[1] Berry, Brian J. L., Simmons, James W., and Tennant, Robert J. (July 1963) "Urban Population Densities: Structure and Change", Geographical Review, Vol. 53, pp. 389-405.

[2] Clark, Colin. (1951) "Urban Population Densities", Journal of the Royal Statistical Society, Series A. Vol. 114, pp. 195-218.

[3] Ginsburg, Norton (ed.). (1969) Aldine University Atlas. Chicago: Aldine Publishing Co.

[4] Mills, Edwin S. (1969) "The Value of Land", in The Quality of the Urban Environment ed. by Harvey S. Perloff. Washington, D. C.: Resources for the Future, Inc.

HANDBOOK ON ENVIRONMENTAL EDUCATION
WITH
SELECTED INTERNATIONAL CASE STUDIES

by
Robert N. Saveland

The idea for an international handbook on environmental education gained expression in the resolutions of the first International Working Meeting on Environmental Education in the School Curriculum held at Foresta Institute for Ocean and Mountain Studies in the summer of 1970. The idea gained further impetus when Jan Cerovsky, then Education Executive Officer of the I.U.C.N. (International Union for the Conservation of Nature and Natural Resources), came to the Southeastern Regional Conference on the Social Sciences and Environmental Education at The University of Georgia in April of 1971. An outline for the project was drafted the following weekend on Sapelo Island. In October of 1971, UNESCO granted a contract to I.U.C.N. for the preparation of this handbook. Throughout its early development, the project enjoyed the active support and encouragement of P.C. Bandyopadhyay, then of the Section of Curriculum and Research, UNESCO.

Members of the writing team and others involved in the project met at the International Youth Conference on the Human Environment at McMasters University, Hamilton, Ontario, in August, 1971. Further meetings were held at the European Working Conference on Environmental Conservation Education at Ruschlikon, Switzerland, in December 1971 and at the International Workshop on Environmental Studies in Higher Education and Teacher Training at the University of Western Ontario in September 1972. The first draft edition of the handbook was published in mimeographed form and mailed to readers around the world in March 1973.

The members of the original writing team with their chapter responsibilities were as follows:

1 - 2 Robert N. Saveland, editor

3 Matthew Brennan, Brentree Environmental Center, Milford, Pennsylvania

4 John Y. Jackson, then Department of Education, State of South Carolina

5 David Withrington, International Youth Federation for Environmental Studies and Conservation, London, U.K.

6 Michel Maldague, Universite Laval, Quebec, Canada

7 Richard G. Miller, Foresta Institute for Ocean and Mountain Studies, Carson City, Nevada followed by

James Cleary, Sunland, Tallahassee, Florida

The editor was greatly helped throughout the project by frequent communications from Ian Horse-Lacy, Environmental Scientist, C.R.A., Melbourne, Australia.

Because of the cost of air postage, the first draft edition had to be sent by surface mail. In several instances, one year elapsed before the book reached its destination. Approximately 150 copies were mailed to environmental education leaders with a request for their comments and contributions toward refining the project. Each of the members of the Commission on Education of the I.U.C.N. received a copy.

Special notice should be taken of certain members of the first international meeting on environmental education at Carson City who followed the project since its inception, particularly, S. Doraiswami (India), Sidy Lamine Gueye (Senegal), E. Selai Mohapi (Lesotho), V. Ninan (Nigeria), Rudolph J.H. Schafer (USA), William M. Taylor (USA), Yozo Tshukamoto (Japan/USA), and Harry Wals (The Netherlands).

Members of the I.U.C.N. Commission on Education who fully responded to requests included James L. Aldrich (USA), W. Erz (Federal Republic of Germany), Ricardo Luti (Argentina), and Vice-Chairman T. Pritchard (U.K.). The Chairman of the Commission is L.K. Shaposhnikov (U.S.S.R.).

The Handbook is organized around the following chapters:

1 Perspectives
2 Curriculum Design
3 Method
4 Materials, Facilities and Media
5 Youth Involvement and Community Action
6 Evaluation
7 Teacher Education

Inasmuch as this session is on "Instructional Materials for Environmental Education", I shall read a part of Chapter 4 in order to give an idea of the nature of the contents of the Handbook. This chapter was prepared by Dr. John Y. Jackson who is now at the Environmental Learning Center at Isabella, Minnesota.

CHAPTER 4
MATERIALS, FACILITIES AND MEDIA*

Accessibility

Environmental education can undoubtedly be carried on with fewer "tools" than traditional subjects require. In fact, there are persons who feel that a textbook is inimical to environmental education. Environmental education, with its focus on inquiry and outdoor activities, would appear as a boon to those schools for whom an adequate supply of materials has been a chronic problem.

---

* I.U.C.N.

Nevertheless, materials and equipment can facilitate and improve the quality of environmental studies. Any environmental problem investigated in detail soon requires more data than can be supplied by direct observation. Ideally, a school would have a materials resource center, a library and a film room which would contain information useful to the student. In addition, each classroom would contain readily accessible materials. In practice, however, materials remain in short supply for hundreds and thousands of students and teachers in the world's schools.

One of the problems associated with educational materials is that of dissemination. How are teachers to know that certain materials exist? In a centralized system of education this problem is met by edict in that certain materials are provided for the teacher. There are always other materials, however, which are outside the scope of officially-provided materials, yet which may be available and useful for the teacher or curriculum planner. This is especially true for environmental education.

The specialist must, of course, attempt to keep abreast of the development of materials within a field. The proliferation of materials and the scope of environmental education has made difficult this job of keeping current. In recognition of this need, a system of Educational Resource Information Centers (ERIC's) were established in the United States. The centers, located in various parts of the country, each focus on a particular discipline, or area of interest. The ERIC for environmental education is located at Columbus, Ohio. Case Study 4-1 gives further details on this ERIC's services.

Other countries have long-established centers for information related to environmental education, such as the Commonwealth Institute in London and the Central Laboratory for Nature Conservation in Moscow. There has been a recognized need for an international information center. In 1974 the Center for International Environmental Information began as a part of the United Nations Environment Program (UNEP). Although its interests are on world environmental problems, its services should be useful to environmental educators. The center, located at 345 East 46th St., New York, NY 10017, publishes World Environment News. Another "World Environment Newsletter" prepared by Philip W. Quigg for the International Institute for Environment and Development is published as a regular feature of the periodical, Saturday Review World (New York).

A cataloging of available materials is not within the scope of this chapter. One needs to maintain a card file, or looseleaf notebook for this purpose. However, references will be made to sources of such information. For instance, Case Study 4-2 is a list of selected useful bibliographics.

Printed Materials

Traditionally, textbooks for environmental education have been directed toward the established curriculum. The Biological Sciences Curriculum Study (BSCS) is an example of a major effort to improve instruction and materials in science education. The resulting books have received world-wide attention and have a considerable environmental emphasis. Pages from Biological Science: Patterns and Processes are reproduced as Case Study 4-3. From this it is possible to see the focus on laboratory activity, and the use of directed questions leading to independent thought.

Also included in Case Study 4-3 are two pages from the textbook, World Resources, concerning "Fishing and Forestry South of the Sahara." From these pages it is possible to observe the textbook's function of organizing and presenting information. Later, the question is raised, "What problems do governments have in trying to achieve greater fishing production in tropical Africa?" While this is an environment-related question, this section is mainly concerned with resource development. If the material were being written in the mid-1970's, there would be greater emphasis on the possible effects of development on fish populations. The material in this selection would be difficult for students to research on their own with their usual sources of information, but it represents a step towards understanding environmental and social factors in the world's food problem.

Elementary environmental education materials were developed in the late 1960's and early 1970's. Most of this materials has been in the form of lesson units, packets or modules to be used for a period of a few days or weeks and is not tied directly to any one textbook or course of study. This material has the advantage of being flexible in terms of scheduling during the term. However, such material is often looked upon as an added attraction, something to be engaged in if time permits.

Environmental awareness and issues are being worked in to more and more textbooks at both the elementary and secondary levels. This raises the question of whether or not a textbook that has a short section on air pollution falls into the category of environmental education material, or must it have an environmental theme running throughout? Perhaps the best way to judge this is to examine the objectives of the book. Is it stated or implied that the student should gain a better understanding of his environment and the interacting factors within that environment? Is there content to support this? If so, the book could be considered environmental education material.

Beyond the textbook, there is a wide range of books that come under the heading of supplementary material. Trade book publishers put out many of these each year and Case Study 4-4 is a list of selected ecology books for children. In addition to the trade publishers, organizations such as the Sierra Club, Audubon Society and Friends of the Earth have produced beautiful and useful books. The impact of a single book on the thinking of the people of a nation and the world is exemplified in Rachel Carson's Silent Spring. This book is joined by A Sand County Almanac, Walden, The Population Bomb and The Limits to Growth in the Environmental Books Hall of Fame (Beckman 1974).

In an effort to assist teachers in relating environmental education to the existing curriculum, various guides have been developed. An example of this is the South Carolina Conservation Curriculum Improvement Project which began in 1966 and culminated in the publication of a series of books entitled People and Their Environment (Brennan 1969). The project utilized writing teams of teachers working within a conceptual framework developed with the help of specialists and consultants. The guides follow the format of having a collection of lessons that relate to specific topics or concepts ie., "The characteristics of groups stem from interaction between individuals and groups," (People and Their Environment Social Studies Guide 7-8-9, p. 89), or "Matter can neither be created or destroyed, simply transformed," (People and Their Environment Science Guide 7-8-9, p. 89).

Some less formal teaching guides which almost take on the characteristics of trade books are represented by Mark Terry's Teaching for Survival* and Ward and Fyson's Streetwork; The exploding school. In the Preface, Ward and Fyson explain what they attempt to do in their book:

> It is mainly concerned with the environmental education of the non-academic urban child--in other words with the vast majority of the population. It is a polemical book, not a source book--though copious reference is made to the resources available to the teacher. Nor is it just about techniques, though ample reference is made to methods teachers have found successful. It is a book about ideas: ideas of the environment as the educational resource, ideas of the enquiring school, the school without walls, the school as a vehicle of citizen participation in environmental decision, ideas above all about a 'problem-oriented' approach to environmental education.

The last chapter of Streetwork is on sources and resources and, as such, complements the work of this chapter. Here the authors point out that, "The streetwork teacher's textbook is the town, but his principal teaching resource is himself." (p. 122) Sample pages from this chapter are reproduced as Case Study 4-5, including the section on games and simulations.

Perhaps the category "printed materials" is stretched somewhat to include games and simulations, but these devices usually included printed instructions, data sheets, or background information. Generally, some reading skill is required for the student to participate. Games have a motivational factor linked to the simulation of reality and to the competitive spirit. One wonders if rivalry is an innate characteristic of children, or is it largely culturally determined? A disadvantage of games is the amount of class time they consume. The same concepts can usually be presented by other methods in less time, albeit with perhaps less effectiveness. As with other methods, the main point of the game may sometimes be lost by the participants.

From here, the chapter moves into a discussion of environmental study areas. The Handbook is intended for a world audience and therefore the authors and editor tried to keep in mind the readers in developing countries. John Wiley & Sons, Ltd. in London is publishing this Handbook, and publication is scheduled for later this year.

---

*Reviewed by Robert N. Saveland in The Journal of Geography, Vol. 71, No. 3, March 1972, pp. 188-189.

THE DEVELOPMENT OF HARDWARE AND SOFTWARE FOR AN EFFLUENT MONITORING PROCEDURE PROGRAM

by
Carl M. Schwing
and
William T. Engel

From the President of the United States to the man in the street, there is general agreement that our environment is in danger. The 1970's have been declared the "Decade of the Environment"; however, nearly six billion dollars will be invested in wastewater treatment facilities in the coming year. To achieve maximum return on this money, man power with the proper motivation is necessary to manage these facilities. Many community colleges have taken up the challenge to supply trained technicians for this work.

The Charles County Community College was founded in 1958. The college is located in a rural county, 25 miles south of Washington, D. C. Since 1966, the college has been involved in the training of operators and technicians in the water quality field. In 1969, a two-year Pollution Abatement Technology Program (PAT) leading to an Associate in Arts Degree was initiated. At the same time a Science and Technology Center was being designed to accommodate the Electronic Data Processing, Electronics, and Pollution Abatement Technology programs.

The two-year PAT program (Appendix, Exhibit A) is designed to produce technicians for operating agencies, regulatory agencies, consulting engineers and manufacturers. The program consists of:

Communication Skills	9 hours
Mathematics	8 hours
Chemistry	16 hours
Biology	3 hours
Physics	8 hours
Business Administration	4 hours
Pollution Abatement Technology	22 hours
Physical Education	2 hours
Total	72 hours

In addition to the two-year PAT program, the college annually presents additional short courses in the water quality field. One of the most notable of these is the series on Effluent Monitoring Procedures.

The Water Pollution Control Act of 1972 (PL 92-500) requires that each point of wastewater discharge have a National Pollutant Discharge Elimination System (NPDES) permit. One of the requirements to comply with this permit is the routine reporting of effluent quality to ensure compliance with the stipulations of the permit. The methods for determining the parameters have been specified in the Federal Register.

Many wastewater operator certification examinations fail to cover laboratory analytical procedures in sufficient detail to ensure adequate knowledge by the operator. In fact, in states where laboratory analytical procedures are

thoroughly covered by the certification exam, it is found that this is a major stumbling block to successful passing of the examination. Likewise, some operator training programs lack uniform standards of training in laboratory procedures.

Through a grant from EPA and in cooperation with the National Testing Center in Cincinnati, the Charles County Community College has developed a program of instruction entitled "Self Monitoring Procedures". The following is a brief description of each course:

Course I: Basic Laboratory Skills

This course is designed for the treatment plan operator or technician who is required to monitor effluent discharges under a NPDES permit and who has had little or no previous experience in laboratory work.

The course includes a review of basic mathematics. Applications in the chemical laboratory such as weighing techniques, use of equipment and solution preparation are stressed. An introduction to basic microbiological techniques is also included.

Prerequisites: An individual is eligible for the program who is employed as an operator or a technician in a wastewater treatment facility but does not possess the necessary skills to perform the basic analyses.

Course II: Basic Parameters for Municipal Effluents

This course is designed for the treatment plan operator or technician who is required to monitor effluent discharges under NPDES permit and who has had little or no previous experience in wastewater analysis or flow measurement.

Parameters included in this course are BOD_5, pH, fecal coliform, residual chlorine, suspended solids, and open channel flow. At the conclusion of this training the student is familiar with the standard test procedure for each parameter, has performed each analysis, and is able to use a Parshall flume or weir to measure effluent flow. He also knows what equipment and supplies are needed in connection with each procedure.

Prerequisites: The participant should have an ability to perform basic mathematical calculations using whole numbers, fractions and decimals. Self-monitoring procedures: Course I - Basic Laboratory Skills or equivalent experience is prerequisite for the course.

Course III: Nutrient Series

This course is designed for the treatment plant operator or technician who is required to monitor effluent discharges under a NPDES permit and who has had little experience in wastewater analyses.

The course includes the following parameters: organic nitrogen, ammonia nitrogen, nitrate nitrogen, nitrite nitrogen, total phosphorus, chemical oxygen demand

and oil grease. At the conclusion of this training, the student is familiar with the standard test procedure for each parameter and has performed each analysis.

Prerequisites: Participant should have completed Course I - Basic Laboratory Skills or have the equivalent experience. Satisfactory completion of Course II - Basic Parameters for Municipal Effluents is advisable but not required.

Course IV: Metals Analyses

This course is designed for the treatment plant operator or technician who is required to monitor the effluent discharges under a NPDES permit and who has had little or no experience with Atomic Absorption Flame Emission or volumetric methods of metals analysis.

The following metals are determined by atomic absorption methods: lead, mercury, copper, magnesium, manganese and zinc. Flame Emission is utilized in the determination of potassium and sodium. Volumetric analysis is performed on calcium. The course also includes a session on instrumental trouble-shooting and maintenance.

Prerequisites: Participant should have completed Course I - Basic Laboratory Skills or have the equivalent experience. Satisfactory completion of Courses II and III is adviseable but not required.

Student workbooks as well as instructional package worksheets have been or are being prepared for each course level. Course I - Basic Laboratory Skills - contains four modules: Basic Mathematics, Chemical Laboratory, Microbiology, and Laboratory Inventory (Appendix, Exhibit B). The entire program is based on the behavioral objective approach for presentation. (Appendix, Exhibit C). Each lesson, module, and course has its own stated justification, entry level behavior, instructional objective, instructional resources, and instructional approach. Each module has a pre-test and each lesson has a unit quiz. (Appendix, Exhibit D). A check list may take the place of a unit, especially if laboratory techniques are involved.

Trainees are screened by use of an application form which must be filled out by the applicant in his own handwriting. (Appendix, Exhibit E).

Maximum utilization is made of audio-visual aids in each lesson. For the Effluent Monitoring Procedure Course I, the staff utilizes the Modu-Math series which was prepared by the State University of New York and is available in 3/4 inch color video cassette format. Additional material available from the EPA National Training Center in Cincinnati is available in slide tape or video cassette format.

Nearly all chemistry courses in the Pollution Abatement Technology Program and the Effluent Monitoring Procedures Program are team taught. The chief sanitary chemist has a Master of Science degree in chemistry, has six years of experience teaching sanitary chemistry courses, and is a certified wastewater treatment plant operator. A second instructor has a B.A. degree in chemistry and additional graduate work in civil and environmental engineering; he also is a certified wastewater treatment plant operator. A third instructor has a B.A. degree

in science and a M.S. degree in environmental engineering, as well as a wastewater treatment plant operator certificate. The division director is a registered professional engineer with 19 years experience in public works and is certified as a wastewater treatment plant operator in four states.

In addition to an effective staff and delivery system, superior physical facilities are necessary for these highly intensive training programs. Eleven thousand square feet of area at the college are specifically designed and dedicated to the Pollution Abatement Technology Division. This area includes four classrooms and an office complex. (Appendix, Exhibit F). The maximum number of students who can be effectively instructed in the General Chemistry laboratory is twenty. The Sanitary Chemistry and Micro-biology laboratories can each accommodate a maximum of 15 students. The instrumentation laboratory can accommodate a maximum of 12 students, with ten being the optimum.

The General Chemistry Laboratory contains 904 square feet and is of a slightly unusual design, with five diamond shape laboratory tables, each of which accommodates four students (Appendix, Exhibit G).

The Sanitary Chemistry Laboratory contains 795 square feet. This laboratory is designed so that each student can perform every wet chemistry test listed in <u>Standard Methods</u>. The major equipment includes two eight place water baths, two large muffle furnaces, a large drying oven, four amperometric titrators, four Bausch & Lomb Spectronic 20 spectrophotometers, a three-gallon-per-hour water still, and an enclosed twelve-place Kjeldahl digestion and distillation apparatus. In addition to two normal chemistry laboratory hoods, exhaust hoods connected directly to the exterior atmosphere are located over the dry oven and muffle furnaces to remove excessive heat and fumes from the laboratory. (Appendix, Exhibit H).

A chemical storage room, glassware storage room, and glassware cleaning and sample preparation room are common to both the General Chemistry and Sanitary Chemistry laboratories. (Appendix, Exhibit J). Each of these three rooms contains 230 square feet.

The Micro-biology Laboratory contains 836 square feet. In this laboratory are two walk-in environmental rooms, each of which is eight feet square. The temperature in these rooms can be adjusted to maintain any setting between -30 to 60°C. This laboratory also includes a large water-jacketed incubator, hot air sterilizer, anaerobic incubator, refrigerated water bath, diurnal incubator, and autoclave. Each student station is equipped with a binocular, mechanical stage research microscope as well as a stereo zoom microscope. (Appendix, Exhibit K).

The Instrumentation laboratory contains 863 square feet of space. This laboratory contains a dual column gas chromatograph, infrared spectrophotometer, dropping mercury polarograph, fluorometer, atomic adsorption spectrophotometer. (Appendix, Exhibit L). Adjoining this laboratory is an audio-visual storage room and a revenue laboratory which contains a technicon analyzer (Appendix, Exhibit M).

In the design of laboratories, considerable thought should be devoted to adequate supplies of vacuum and electricity. Muffle furnaces, water baths, extraction stands, stills, and autoclaves should each have their own electrical circuits of adequate capacity. Thought should be given to utilizing 240 volt or three-phase circuits for this equipment.

The college now has over $200,000 invested in equipment for the laboratories and an additional $50,000 in glassware, supplies and chemicals.

It is paramount that for optimum transfer of knowledge, a superior delivery system, well-trained instructors and efficient facilities are required.

APPENDIX A

POLLUTION ABATEMENT TECHNOLOGY

Freshman Year	First Semester	Second Semester
PAT 101, 103	4	4
ENG 101	3	
MTH 150, 151	4	4
CHE 120, 121		
or		
CHE 150, 151	4	4
BIO 105		3
PED 101, 102	1	1
	16	16
Summer Session		
PAT 109	4	
Sophomore Year		
PAT 202	3	
PAT 203		4
BAD 260		4
ENG 205	3	
PAT 205		3
CHE 252, 255	4	4
PHY 150, 151	4	4
SPH 103	3	
	17	19

TOTAL CREDIT: 72

PAT 101 - Introduction to Environmental Health
(4)

An introduction to environmental health designed to teach principles of hydrology, water supply, purification, distribution and sources of pollution (air, water and solids). The characteristics of waste streams and general methods of abatement and basic treatment unit processes will be covered.

- 3 hours lecture, 3 hours lab each week

PAT 103 - Wastewater Treatment Unit Process Operations
(4)

A detailed study of unit processes in wastewater treatment. Normal operation conditions, abnormal conditions, as well as preventative and corrective maintenance practices will be discussed for selected

units of the composite model plant. Actual operation and maintenance of equipment by use of on-site training facilities is stressed.

- 3 lab hours, 3 lecture hours each week

PAT 109 - Plant Practicum
(4)
Prerequisite: PAT 103

A supervised program with emphasis on actual operation of unit processes previously studied with respect to normal operating procedures, indication of abnormal operating procedures, indication of abnormal conditions, performance of preventative maintenance, as well as diagnosis of mechanical malfunctions and remedy of such malfunctions.

- 36 lab hours, 4 lectures each week for 10 weeks

PAT 202 - Plant Engineering Maintenance
(3)
Prerequisite: MTH 151

An in-depth study of wastewater unit processes with particular emphasis on preventive and corrective maintenance procedures. The evaluation of mechanical indications of malfunctions of process unit and the correction of the malfunctions will be required.

- 2 lab hours, 2 lecture hours each week

PAT 203 - Environmental Technical Laboratory
(4)
Prerequisite: PAT 101, 103 & CHE 252

Laboratory plant scale studies of the unit processes utilized in the wastewater treatment plant field. The interaction of the various unit processes of the composite model plant will be stressed; demineralization and ion exchange, effect on coagulant aides on particulate matter, bacterial populations and disinfection, and advanced waste treatment.

- 2 hours lecture, 6 hours lab each week

PAT 205 - Industrial Waste Control and Management
(3)
Prerequisite: PAT 101, 103 & CHE 252

Industrial waste characterization and quantity evaluation. Methods and applications of physical, chemical, and biological treatment. Laboratory analysis of industrial wastes. Report preparation.

- 2 hours lecture, 4 hours lab each week

APPENDIX B

SUMMARY INSTRUCTIONAL PACKAGE WORKSHEET

SUBJECT MATTER: Self-Monitoring Procedures:
Course I - Basic Laboratory Skills

UNIT OF INSTRUCTION: Total 4

ESTIMATED TIME: 31 hours

JUSTIFICATION: In accordance with the National Pollutant Discharge Elimination System (NPDES), five basic parameters and others as designated by state agencies are required for reporting purposes by all wastewater treatment facilities. The basic laboratory skills necessary to satisfactorily determine these parameters are included in this package.

ENTRY LEVEL BEHAVIOR: Any individual who is employed as an operator, or technician in a wastewater treatment facility but does not possess the necessary skills to perform the basic analyses, will be eligible for the program. He must have completed an acceptable registration form as shown in Appendix I.

A. INSTRUCTIONAL OBJECTIVE

1. Terminal Behavior - The student will satisfactorily complete all units of instruction.

2. Conditions - Classroom instruction and demonstration. Laboratory application using supplies as designated in the lesson.

3. Accepted Performance - As stipulated in individual lessons and satisfactory completion of individual module evaluations.

B. INSTRUCTIONAL RESOURCES

1. Available Media - See Appendix II.

2. Suggested Media - Slides, overheads and video tape cassettes showing laboratory equipment and specific procedures.

C. INSTRUCTIONAL APPROACH

Module I - Basic Mathematics	(3 hours)
Module II - Chemical Laboratory	(23 hours)
Module III - Microbiology	(4 hours)
Module IV - Laboratory Inventory	(1 hour)

APPENDIX C

INSTRUCTIONAL PACKAGE WORKSHEET

SUBJECT MATTER: Basic Mathematics

UNIT OF INSTRUCTION: Summary of Instruction on Mathematics

LESSON NUMBER: Total 5

ESTIMATED TIME: 3 hours

JUSTIFICATION: To orient the student in calculation of results for the NPDES.

ENTRY LEVEL BEHAVIOR: Student must be registered in Course I - Basic Laboratory Skills.

A. INSTRUCTIONAL OBJECTIVE

1. Terminal Behavior - The student will satisfactorily complete the five units of instruction on Basic Mathematics.

2. Conditions - Oral and written presentation with use of handouts.

3. Accepted Performance - 90% correct score.

B. INSTRUCTIONAL RESOURCES

1. Available Media

239	519	689	2008
442	620	2002	3009
476	627	2007	

2. Suggested Media

Textbook for the student and wall chart of the Metric System

C. INSTRUCTIONAL APPROACH (SEQUENCING)

A pre-test (Appendix III) covering Lessons I - V will be given at the beginning of this unit. Satisfactory completion of this pre-test allows student to omit these lessons.

Lesson I - Metric System	(30 minutes)
Lesson II - Whole Numbers	(30 minutes)
Lesson III - Decimals	(30 minutes)
Lesson IV - Formulas	(30 minutes)
Lesson V - Percentages	(30 minutes)

APPENDIX D

BASIC MATHEMATICS

PRE-TEST

1. Given the following table, list one Metric and one English unit for the listed measurements.

	Metric	English
Mass	_______	_______
Length	_______	_______
Volume	_______	_______
Temperature	_______	_______

2. State the numerical value for the following metric prefixes.

Kilo	_______
Centi	_______
Milli	_______

3. Add:

$$\begin{array}{r} 156 \\ +\ \underline{24} \end{array} \qquad \begin{array}{r} 79 \\ +\ \underline{62} \end{array}$$

4. Subtract:

$$\begin{array}{r} 50 \\ -\ \underline{12} \end{array} \qquad \begin{array}{r} 262 \\ -\ \underline{79} \end{array}$$

5. Multiply:

$205 \times 82 =$

$98 \times 17 =$

$642 \times 8 \times 3 =$

$(24)(7) =$

6. Divide:

13,888/124

966/ 23

7. Round the following to the nearest ten:

(a) 47

(b) 912

8. Round the following to the nearest hundred:

(a) 847

(b) 75,619

9. Add:

$$\begin{array}{r} 0.269 \\ 4.2 \\ 24 \\ + \underline{\;1.04\;} \end{array} \qquad \begin{array}{r} 59.6 \\ + \underline{\;0.37} \end{array}$$

10. Subtract:

$$\begin{array}{r} 12.6 \\ - \underline{\;0.8} \end{array} \qquad \begin{array}{r} 27.3 \\ - \underline{\;4.9} \end{array}$$

11. Multiply: $2.35 \times 0.05 =$

$(45.38)(1,000) =$

12. Divide: 25.8/3.9

615.6/1.5

13. Round off to the nearest tenth:

(a) 8.9074

(b) 3.26

14. Round off to the nearest thousandth:

(a) 94.66241

(b) 0.5358

15. Given $A = (B - C)/D$. Find A when $B = 24.6239$, $C = 24.5197$, $D = 10$

16. Given $A = B \times C/D$. Find A when $B = 6.4$, $C = 7.9$, $D = 3.2$

17. Express the following as percentages:

(a) 0.05

(b) 0.79

18. Calculate the following and express answers as percentages:

(a) $\frac{300 - 24}{300} \times 100 =$

(b) $\underline{220 - 1\text{[illegible]}} \times 100 =$

APPENDIX E

TRAINEE APPLICATION FORM

COURSE TITLE____

COURSE DATE____

APPLICANT'S NAME____

MAILING ADDRESS____

CITY & STATE____

EMPLOYER____

TELEPHONE NO. EMPLOYER____

TELEPHONE NO. RESIDENCE____

OPERATOR CERTIFICATION HELD____

YEARS EMPLOYED IN THE FIELD____

LAST YEAR OF SCHOOL COMPLETED____

DESCRIPTION OF YOUR PLANT PROCESS____

____

____

DESCRIBE YOUR LABORATORY EXPERIENCE____

____

____

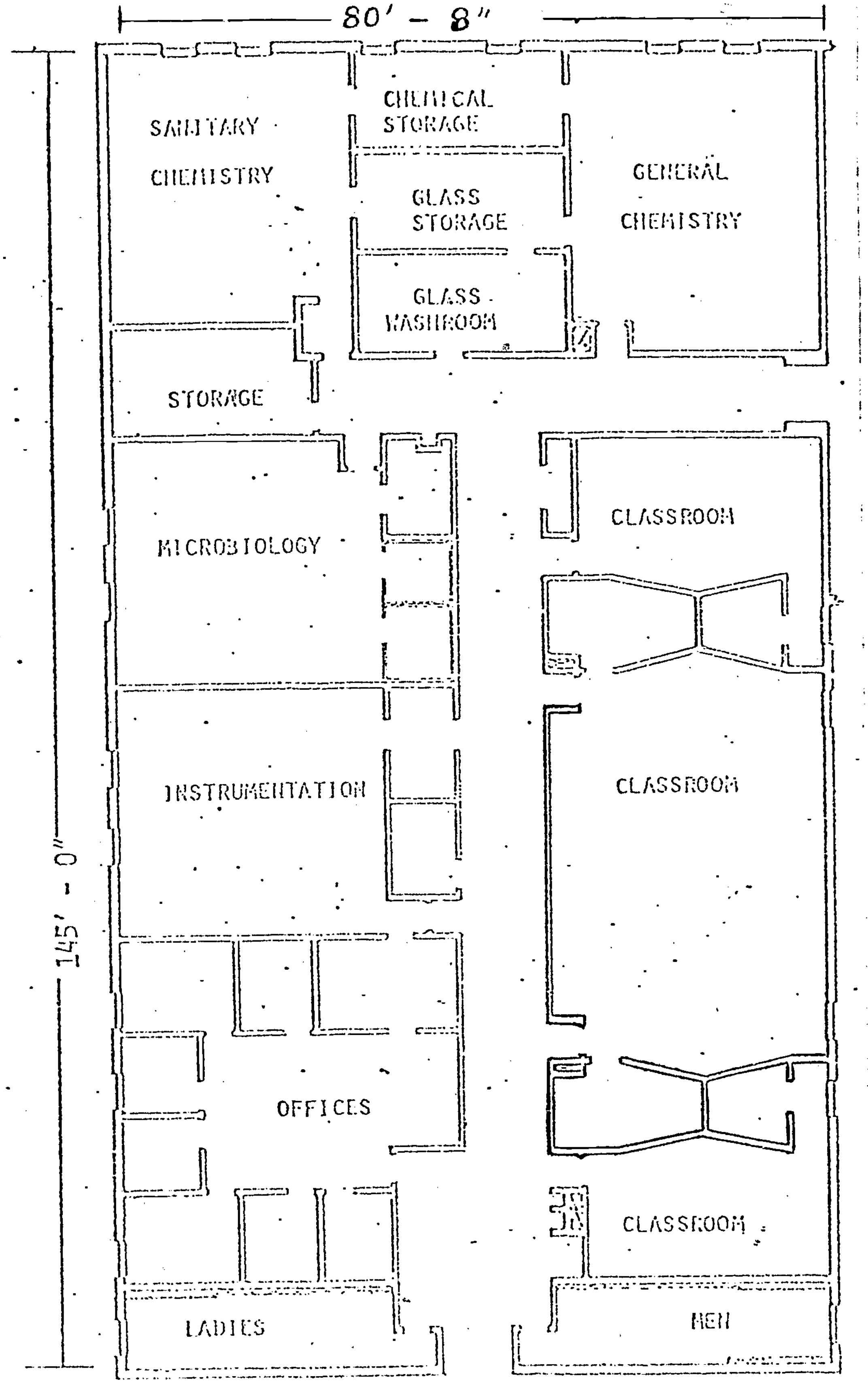
DESCRIBE YOUR DUTIES____

____

____

Notice: This application must be filled out personally by the applicant in his own handwriting.

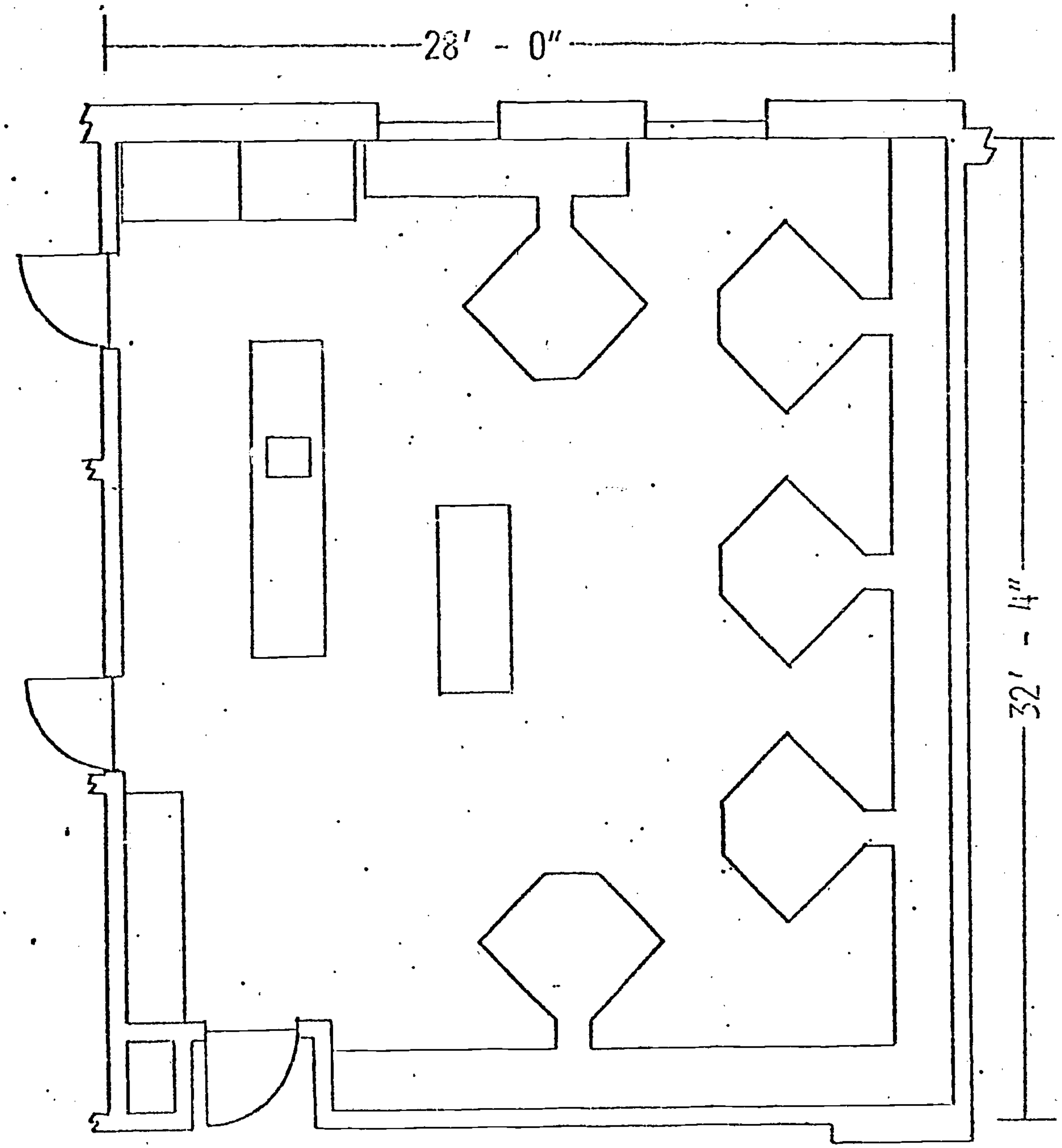
Mail To: William T. Engel, Course Coordinator
Pollution Abatement Technology Division
Charles County Community College
P. O. Box 910
La Plata, Maryland 20646



POLLUTION ABATEMENT
TECHNOLOGY SECTION

APPENDIX F

45

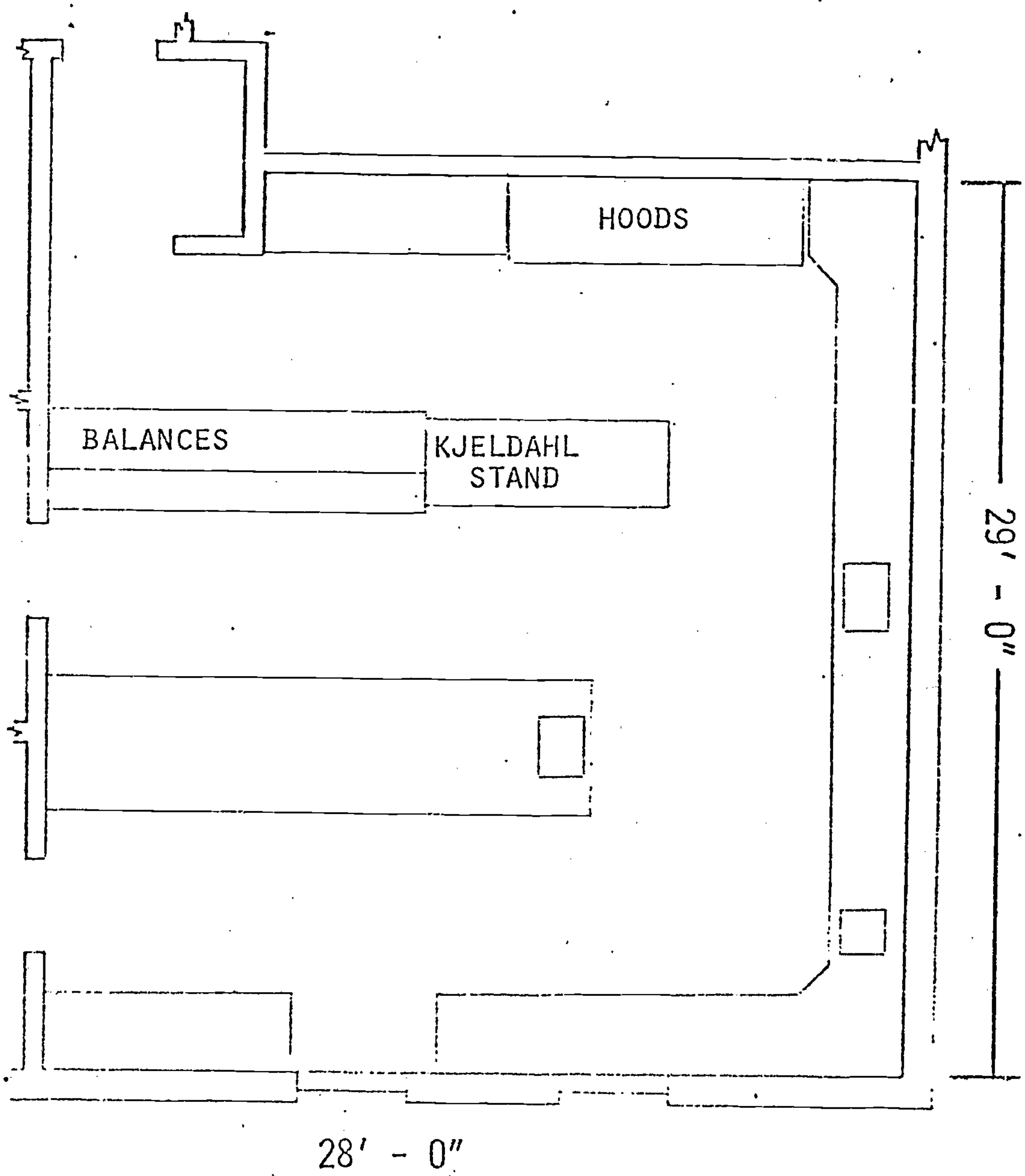


GENERAL CHEMISTRY LAB

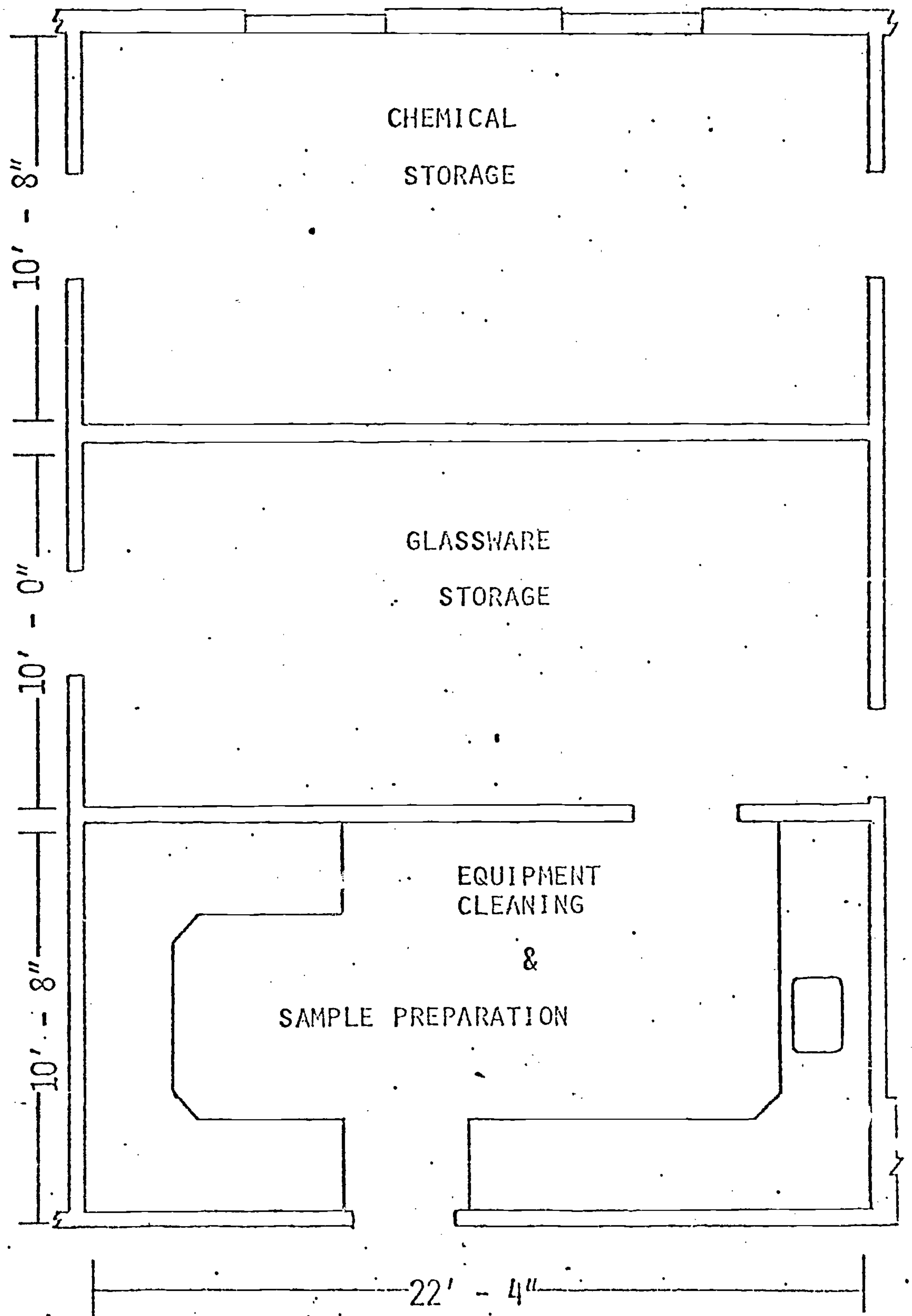
APPENDIX G

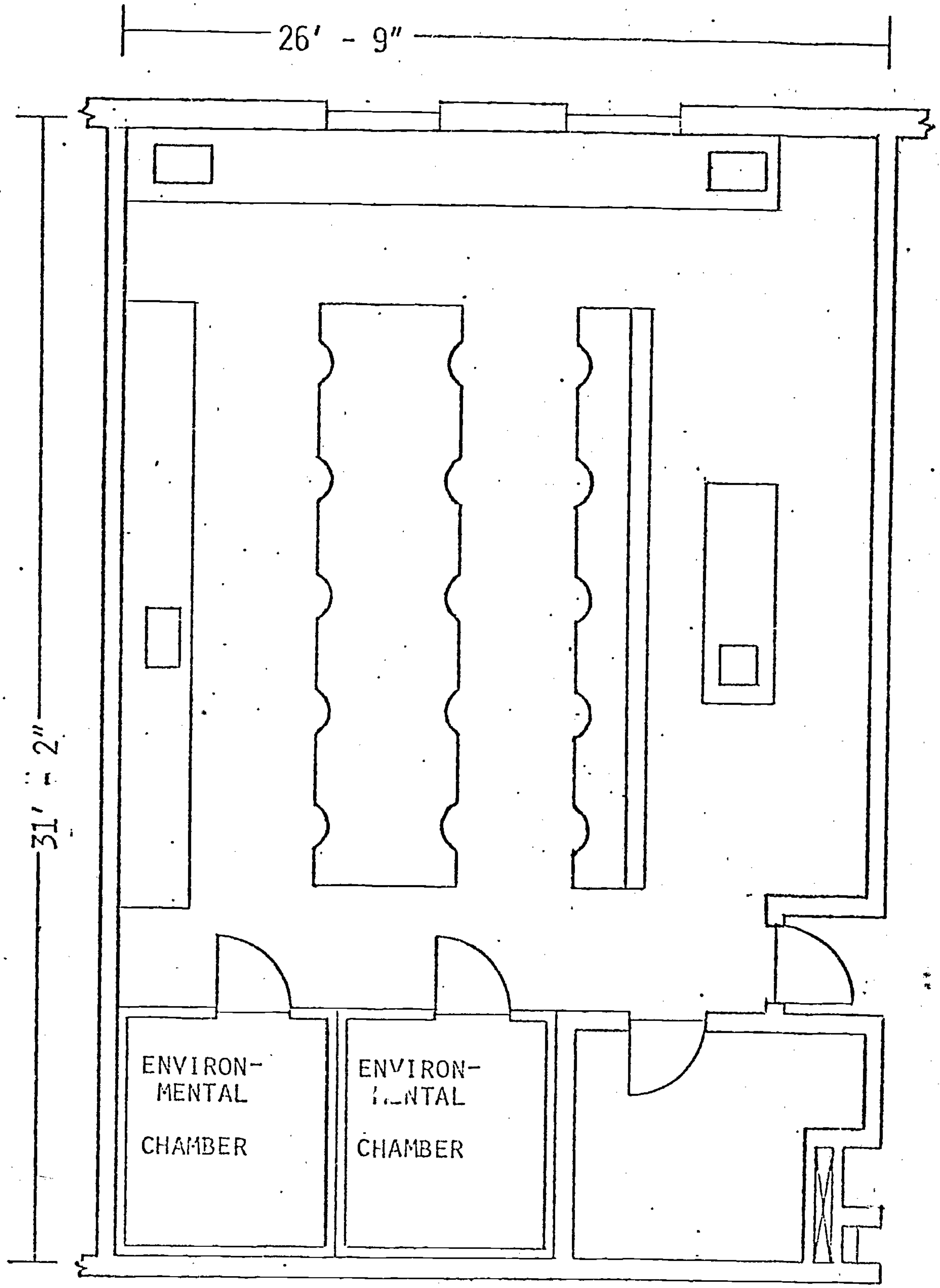
 BEST COPY AVAILABLE

APPENDIX H

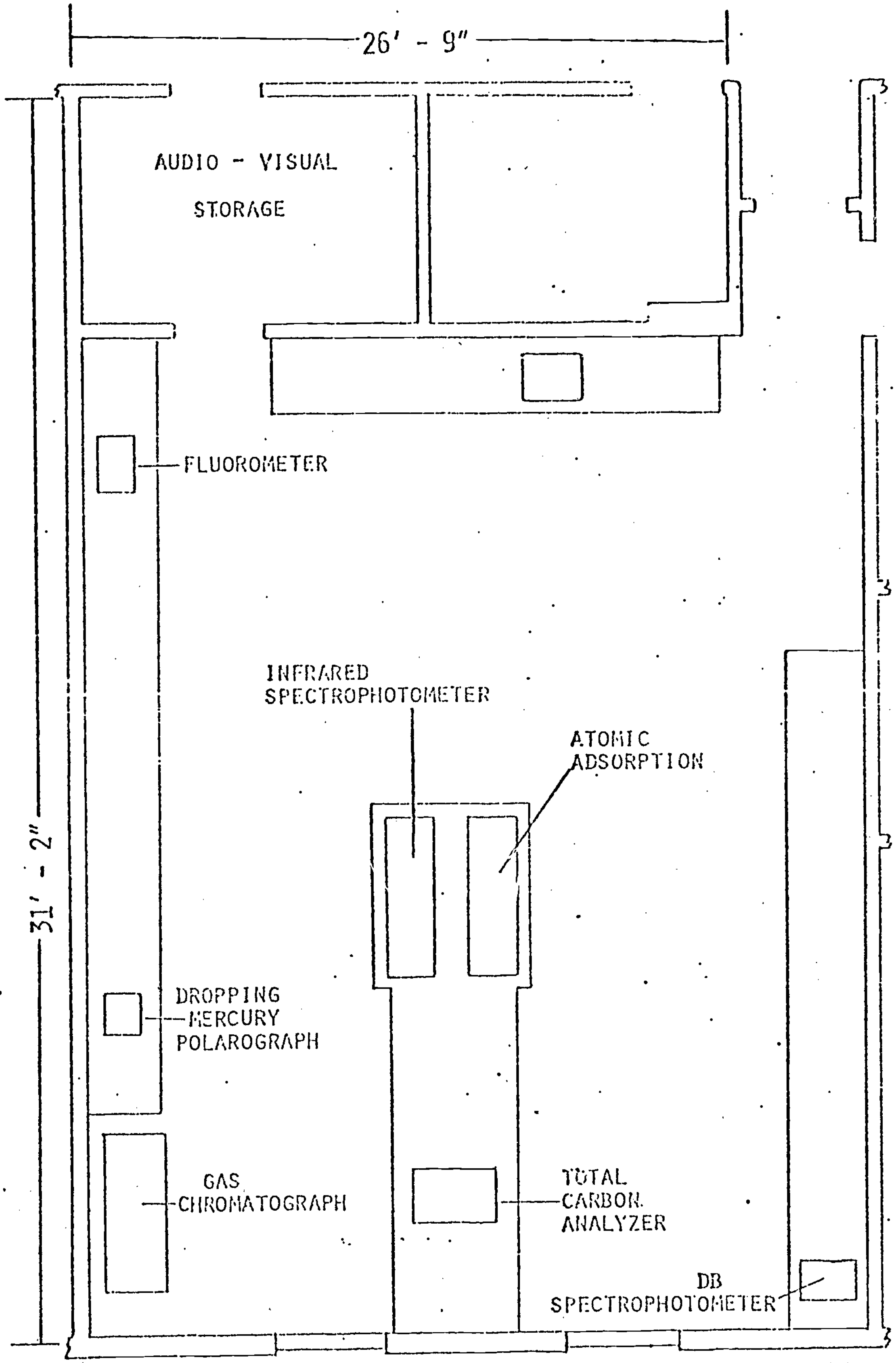


SANITARY CHEMISTRY LABORATORY

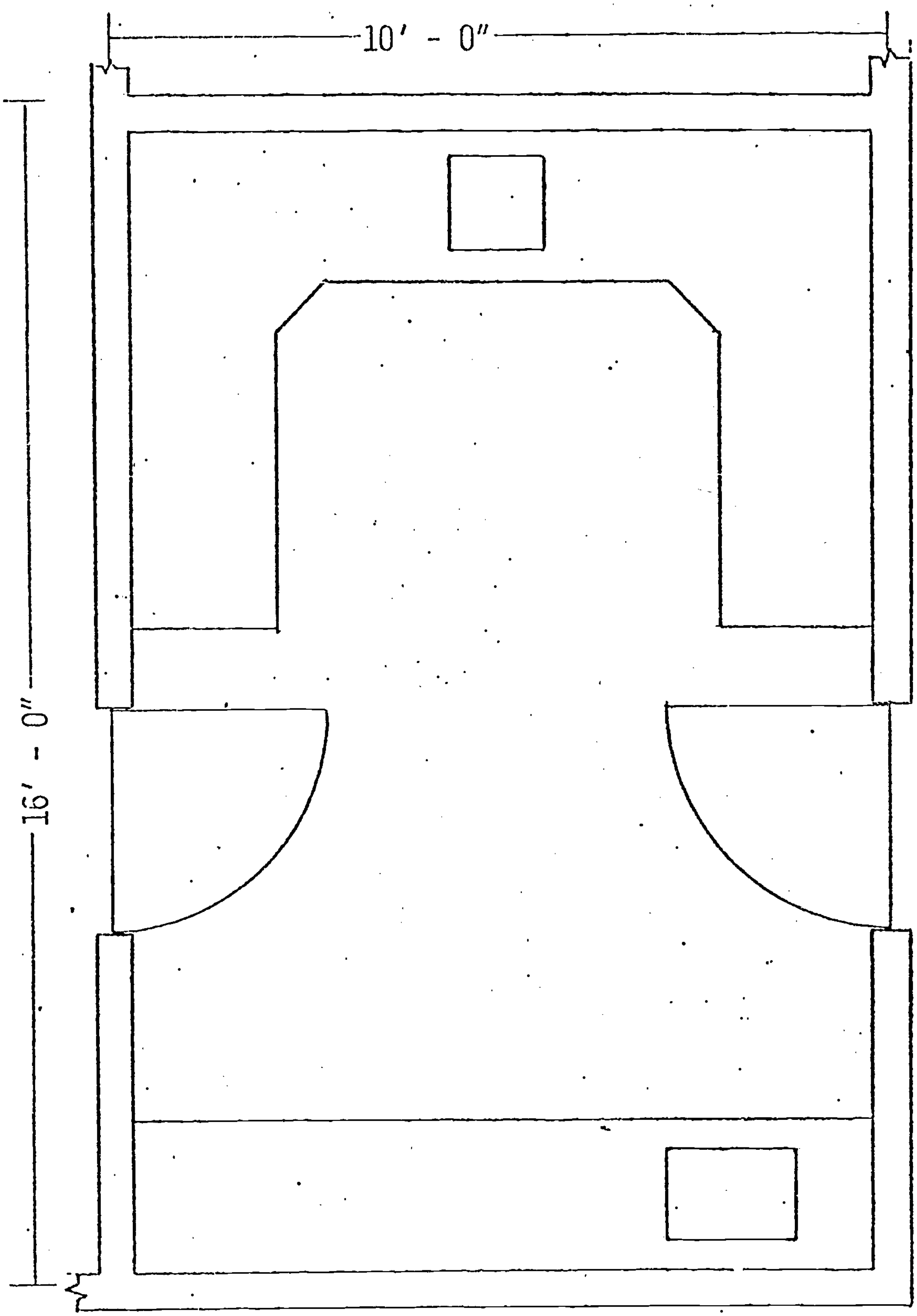

CHEMICAL
STORAGE
GLASSWARE
STORAGE
EQUIPMENT
CLEANING
&
SAMPLE PREPARATION
10′ - 8″
10′ - 0″
10′ - 8″
22′ - 4″



MICROBIOLOGY LAB



INSTRUMENTATION LABORATORY



51 BEST COPY AVAILABLE

REVENUE LAB

ENERGY POLICY

by
Toufiq A. Siddiqi
School of Public & Environmental Affairs
Indiana University

Introduction

Perhaps it should not really be surprising that almost two years after the Oil Embargo of 1973, the United States still finds itself without a formal energy policy. The whole area is so closely linked with economic activity, employment patterns, environmental quality and foreign policy considerations that one would really need clearly defined and generally accepted national goals in order to have a consistent policy for energy. There is, of course, no agreement where the U.S. should be headed as a nation, and this is reflected in the variety of proposals that have been put forward to cope with the rising costs and reduced supplies of energy. The U.S. Congress, reflecting the lack of popular consensus, has been having a hard time coming up with a plan. The Nixon and Ford administrations have put forward a "Project Independence"(1), but many of its features are unacceptable to Congress. A brief look at some of the features of the Administration's plans may be an appropriate start to a discussion of some of the issues involved.

"Project Independence"

The original version of this, announced by President Nixon in 1973, envisaged U.S. self-sufficiency in energy by 1980. This was to be achieved by rapidly increasing domestic output of energy sources as shown in Table 1(2).

TABLE 1

Master Plan for Energy Independence by 1980, as seen by the Federal Energy Office in early 1974 [ref. 2].

	Million barrels per day oil equivalent		
Domestic Energy Source	1973	1980	1985
Oil	10.9	14.0	15.3
Shale		0.5	1.5
Natural-Gas	11.2	13.2	15.0
Coal	6.9	11.0	12.1
Hydro	1.4	1.5	1.6
Nuclear	0.1	1.3	2.6
Geothermal		0.6	1.0
Total supply	30.5	42.1	49.6
Demand at 2%/yr. growth	36.6	42.1	46.5
Net imports needed	6.1	0	- 3.1

Almost all analyses of this plan found the targets very unrealistic, and a study by the National Academy of Engineering (3) not only rejected the possibility of self-sufficiency in 1980, but felt it unlikely even by 1985. The revised version of "Project Independence" presented by President Ford in his State of the Union Message (4), acknowledges the situation by setting a target of importing three to five million barrels a day by 1985. If the price of oil remains around $11 per barrel, the expected fuel consumption in the U.S.A., by source, is as shown in Table 2 below:

TABLE 2

Projected U.S. Fuel Consumption by Source for 1985
(Source: Project Independence Report-p. 46).

Fuel Source	1972 Consumption (in Quads)	1985 Consumption Assuming Oil Price at $11/barrel (in Quads): Base Case	Accelerated Supply
Oil	22.4	31.3	38.0
Gas	22.1	24.8	25.5
Coal	12.5	22.9	20.7
Hydro & Geothermal	2.9	4.8	4.8
Nuclear	0.6	12.5	14.7
Synthetics	--	--	0.4
Imports	11.7	6.5	0
Total	72.1	102.9	104.1

The Base Case and Accelerated Supply alternatives differ mainly in the degree of government intervention, rate of leasing, and regulatory controls, and are spelt out for each source in Table 3 below:

TABLE 3

Comparison of Base Case and Accelerated Supply Assumptions
(Source: "Project Independence Report"-p. 65)

Energy Source	Base Case	Accelerated Development
Oil	Moderate OCS leasing program (1-3 million acres per year); Prudhoe Bay developed with one pipeline	Accelerated OCS leasing program, including Atlantic and Gulf of Alaska; expanded Alaskan program assuming additional pipeline and authority to develop Naval Petroleum Reserve No. 4
Natural Gas	Phased deregulation of new natural gas; LNG facilities in Alaska	De-regulation of new natural gas; additional gas pepelines in Alaska; gas produced in tight formations

[continued next page]

TABLE 3 [continued]

Energy Source	Base Case	Accelerated Development
Coal	Some federal coal land leasing; phased implementation of Clean Air Act with installation of effective stack gas control equipment; moderate strip mining legislation	Same as BAU with additional leasing and larger new mines
Nuclear	No change in licensing or regulations; added enrichment and reprocessing capability	Streamlined siting and licensing to reduce leadtimes; increased reliability; additional uranium abailability; material allocation
Synthetic Fuels	No change from current policies	Streamlined licensing and siting; financial incentives; increased water availability
Shale Oil	No change from existing policies	Additional leasing of federal lands; modification of Colorado air quality standards; financial incentives; increased water availability
Geothermal	Continued R&D and federal leasing programs	Leasing of federal lands; streamlined licensing and regulatory procedures; financial incentives
Solar	Continued R&D program	Additional R&D expenditures and financial incentives

The figures in Table 2 assume that the domestic output of energy will be increased about sixty percent by 1985. Two fundamental questions that need to be asked are:

1) <u>Can</u> the domestic supply of energy really be increased to this extent?
2) <u>Should</u> the U.S. be consuming over 100 Quads of energy per year by 1985?

Prospects for increased domestic production of energy

The Administration is assuming that by the year 1985, domestic production of oil and coal can almost be doubled, that gas production will be increased somewhat and that nuclear power will be able to supply about 12-14% of the total energy requirements of the country. With the possible exception of coal, these figures are considered to be far too optimistic, both by the energy industry and academia. In a seminar presided over by Rogers C. B. Morten, former secretary of the Interior, Chairman of the Energy Resources Council and the senior Vice-President of Exxon stated (5):

"The Project Independence estimates of U.S. oil production in the business-as-usual-case exceed Exxon's best estimate by 50% and are actually greater than our estimates of maximum achievable production. The accelerated supply case estimates exceed Exxon's maximum estimate by over 40%. The Project Independence report projects 1985 import levels of 3.3 million b/d in the business as usual outlook while Exxon estimates oil imports of 11.5 million b/d in its most comparable outlook. The accelerated-supply case projects no imports and spare producing capacity by 1985, compared to oil imports of 2.4 million b/d estimated by Exxon under conditions of maximum development and use. . . The net result of these optimistic assessments is to substantially under-state U.S. import needs and overstate the degree of energy independence which can be achieved under both business-as-usual and accelerated-development conditions."

The situation regarding natural gas seems even worse. A recent staff study published by the Federal Power Commission projects that the supply of natural gas in 1985 will be 40% below the peak figure of 22.6 trillion cubic feet achieved in 1973 (6). It concluded that natural gas production in the U.S. will decline indefinitely.

The assumption of having 200 additional nuclear power plants in operation by 1985 is also highly questionable. In less than a year, various utilities have postponed 129 nuclear units from two months to five years, or have completely dropped the plans (7). Not only has the cost of nuclear power jumped sharply, but operational problems have kept many plants idle more than 50% of the time. A former director of licensing for the Atomic Energy Commission, John O'Leary, feels that "We may see a lot of bloom going off the nuclear rose," and that about 125 nuclear power plants may be operating by 1985 (7).

The result of these optimistic energy production figures is that planning can be continued on the basis of continued energy growth in the economy. Its likely outcome is that the U.S. will be even more dependent on energy imports in 1985 than it is today.

Emphasis on Energy Conservation

As long as the oil embargo was in effect, a genuine effort was made to conserve energy: car pools were formed, Christmas lights were switched off, thermostat settings were changed and use of public transportation was encouraged. With the lifting of the embargo, the pressure was removed and the situation gradually returned to what it had been before. The attempt to rely on "voluntary" energy conservation has resulted in more oil being imported now than was the case before the embargo. The heavy emphasis on production rather than conservation is clearly reflected in the President's FY1976 budget for Energy Research and Development (8) shown in Table 4.

TABLE 4

Energy R&D Budget for FY1976
(Source: Information from ERDA, Vol. 1, No. 14)

Program	President's Budget Authority (In $ Million)
Nuclear Fission Reactors & Fuel Cycle	775
Nuclear Fusion	226
Fossil Fuels	391
Solar Energy	70
Geothermal Energy	24
Advanced Energy Systems	24
Conservation	41
Total Direct Energy Programs	1551

Thus, less than 4% of the total funding for direct energy programs is directed towards energy conservation in spite of the fact that conservation is more likely to have a quicker payoff. There are indications that the desirability of emphasizing conservation is now being realized, and this is reflected by the Energy Research & Development Administration (ERDA) requesting in its budget amendments another $32 million per research directed towards energy conservation. Furthermore, the President is at least partly basing his reasons for oil price decontrol on the need for reducing consumption of this fuel.

The reduction under discussion, however, seems to be one only from historical growth rates and not an absolute one. Automobile fuel use projections made by the Federal Energy Administration (1) for oil selling at $4, $7, and $11 per barrel are shown in Fig. 1. Even with oil at $11 per barrel, automobile fuel consumption is expected to be about 50% higher by 1990.

The main concerns about a levelling-off of energy consumption in the U.S. seem to be a possible result in considerable economic disruption, widespread unemployment and a reduction in the standard of living. This is usually argued on the basis of historical trends which show a good correlation between per capita energy consumption and per capita GNP. Such arguments frequently ignore the fact that several countries (such as Sweden and Switzerland) have almost the same per capita GNP as the United States, but utilize only 50% or less energy per capita than this country. More efficient use of energy in the U.S. would involve some adjustments, but not a decline in living standards.

In a course I teach at Indiana University, students are asked to draw up their energy budget for the past year and analyze the effect on their lives of reducing the total energy consumption by 20%. About 90% of the students find that this would not be too difficult, and that their "Quality of Life" would not be significantly reduced.

Studies by Hannon and co-workers (9) have shown that most U.S. industries have been trading labor for energy as they grow, and that economic growth can still be achieved by emphasizing industries that minimize energy growth and maximize employment demands.

From the point of view of achieving a better quality of the environment, the advantages of a conservation-oriented strategy to an increased production policy are so obvious that I have not tried to describe them in detail. The problems associated with the production and utilization of both fossil and nuclear fuels are well known. What is frequently overlooked is that even so-called "non-pollutants" like the carbon dioxide produced in all combustion processes may cause changes in the earth's climate over the decade. Similar results could also be brought about by the heat generated as a result of increased energy utilization if the rate of growth of the latter remains the same world-wide for a century or so. Everyone has heard by now that the U.S., with 6% of the world's population, uses over 30% of its total energy. In a world where not only the resources but our potential for utilizing energy is limited by the laws of thermodynamics, it is imperative that the United States take the lead in a move away from the "more is better" attitude to one that asks "How much is enough?"

References

(1) Federal Energy Administration. Project Independence Report. Washington, D.C.: U.S. Government Printing Office, November 1974.

(2) Kinney, Gene T. "Project Independence: Is It Out of Reach for U.S.?" Oil and Gas Journal (March 4, 1974).

(3) National Academy of Engineering. U.S. Energy Prospects: An Engineering Viewpoint. Washington, D.C.: National Academy of Engineering, 1974.

(4) Executive Office of the President. "State of the Union Message." January 15, 1975.

(5) "Project Independence Data Attacked." Oil and Gas Journal, (December 16, 1974).

(6) "FPC Warns of Worsening Gas Shortage." Oil and Gas Journal, (January 13, 1975).

(7) "New Nuclear Regulating Agency to Face Hard Decisions on Atomic Power Buildup," Wall Street Journal, (February 3, 1975).

(8) "Background on ERDA FY1976 Budget Amendment," Information from ERDA, Vol. 1, No. 14, (July 2, 1975).

(9) Hannon, Bruce. "Options for Energy Conservation", Technology Review (February 1974), 25-31.

ENVIRONMENTAL EDUCATORS

by
Carl Thompson
Executive Vice President and Director
Division of Environmental and Consumer Affairs
Hill and Knowlton, Inc.

Some cave man, a couple of million years ago or so, became the first to light a fire in his cave. And, he also doubtless became the first to discover a direct relationship between energy and the environment as he ran choking from the smoke to the cave's exit.

But this cave man and his brethren did not immediately launch a campaign to outlaw this new form of heat, light and energy. They learned how to control it - after a fashion. They, shall we say, educated themselves to adapt energy to their environment.

And they did not even have to develop an Environmental Impact Statement, or else we probably would still be depending upon our own body heat and energy to keep warm in the caves.

We are still struggling to control that fire in our cave, but nowadays we should understand better that energy and environment are interdependent, not antagonistic. And educators can help achieve that understanding.

If our nation is to achieve a better environment and also provide the abundance of goods and services to be increasingly shared by all our people - and now others in the world - then there is urgent need for informed leadership, intelligent action and educated decisions, particularly in the determination of sensible priorities and wise acceptable choices. We must be careful not to emulate Stephen Butler Leacock's Lord Ronald who "flung himself upon his horse and rode madly off in all directions".

It is important - though probably not possible - to keep our efforts to education and not so much to advocacy. We need to encourage a real understanding of what ecology and environment are all about and not be riding hobby horses off in all directions.

In the three E's area - Education about Environment and Energy - several problems are looming that will not be too easy to handle.

The first problem is a better understanding that energy is what life and society and progress are all about. Plant and animal life, including human life, are in the business of making energy and using it. Where to find or create new energy sources and how to most efficiently and beneficially use energy are now, and are going to be, continuing problems. Our populations and our society are going to continue to want the benefits that only energy can provide. We are not going back to the cave without fire.

Second, how to adapt our environment and our encroachments on the environment to the desires, wants and needs of mankind is in need of reexamination. There is no such thing as, and never has been, a pristine and pure environment.

And man could probably not live in one if it existed - and probably would not want to if he could.

Third, yardsticks by which we measure progress in environmental clean-up and in economic and social progress should be reasonable ones and should be compatible rather than considered as separate. Energy is essential to environmental quality, as even nature knows when she sends lightning into primitive forests to set fires that clean up nature's trash and rotting debris so that the forests and wildlife can thrive better.

Fourth, the public - or rather the diverse publics - should be more completely and accurately informed about the complexities of environmental and energy problems and what can and should be done about them. Here is the major role for environmental educators and communicators.

Having been concentrating in the field of environmental and energy matters for more than 10 years, I am concerned now that there could be a reaction against the continued efforts to protect the environment because of some of the extreme and unnecessary demands that are being made and enforced to the detriment of both the environment and social and economic needs.

Just this year, a survey done among a cross-section of California voters by the California Council for Environmental and Economic Balance, headed by former Governor Edmund G. Brown, found that respondents "by a margin of better than 3 to 1 placed greater importance on job creation than on environmental protection. This was true regardless of voter residence, age, education, family income, or political affiliation".

Some of this attitude must be a reaction to those who have been too extreme in their demands or too biased in their presentations.

It perhaps is a reaction to the way we have plunged into "instant solution" programs for problems that have no instant solutions.

Some scientists are beginning to be concerned at the way their knowledge, or lack of knowledge, is being misused or distorted to advance special causes rather than to accomplish necessary and desired progress.

This past January, a 20-page paper was given at the American Association for the Advancement of Science which showed how the same research information could be used to prove (a) that phosphate detergents were causing excess eutrophication of lakes, or (b) that phosphate detergents had little or nothing to do with this condition. Some research projects were actually set up in order to prove either (a) or (b). The author gave some advice for scientists that perhaps could be used by educators too. Some of his points included:

--Define the problem -- the real problem.
--Accept and report all pertinent facts, especially those that don't appear to support your own theory.
--Strive desperately to be objective.
--Don't over-extend or over-project your results.
--Be aware of your own and others' vested interests.

At this same meeting Professor Mary L. Good of the University of New Orleans discussed the "Use and Misuse of Scientific Data". This is particularly pertinent to the energy situation. Relating to the siting and construction of nuclear power plants, Professor Good said:

> "Those individuals who feel that nuclear power is a necessity for the general health of the country tend to present the available scientific data on radiation hazards in a minimal light, while those individuals who feel that the possible dangers associated with nuclear reactors must negate their construction use the same data to prove their points about the possible hazards involved. A specific example: It is estimated that the routine emissions from a power plant will increase the number of deaths by 8.7 per year from cancer developed as a result of these emissions. This information could be used as a very valuable weapon against the construction of nuclear power plants. However, if the data is presented relative to other risks that the population accepts as normal, the hazard appears negligible since the equivalent risks include (1) being a fraction of an ounce overweight, (2) spending four minutes per year in a city, (3) smoking 0.03 cigarettes per year or (4) driving one mile per year."

Professor Good was not alone in perceiving problems in this area.

Professor Rene Dubos and Barbara Ward, in their recent thoughtful book, Only One Earth, tell how scientific consultants reviewing contents often arrived at diametrically opposite positions. Received the same day, letters from two Nobel laureates commented on the book's treatment of nuclear power for energy. One felt the text did not do full justice to the potentialities of nuclear power and greatly exaggerated its threats. The other Nobel laureate thought that nuclear power should not be developed at all.

"At first sight," Professor Dubos commented, "this discrepancy of opinions appears to constitute evidence for the commonly held view that experts do not agree on facts and therefore are of little help in formulating programs of action. But in reality experts rarely disagree on the validity of the facts themselves; they differ only with regard to the interpretation and use of these facts."

Or, as the poet William Cowper wrote a couple of centuries ago:

> "And diff'ring judgements serve but to declare
> That truth lies somewhere, if we knew but where."

Truth in emotional situations is often difficult to arrive at. What is the truth about excessive control of certain industrial emissions - meaning those which are demanded largely for esthetic or emotional reasons? At present I am working with a number of case histories that show that excessive controls can actually create more pollution than is controlled and waste excessive energy.

Just one example may suffice. In this particular shop, 94 percent of emissions are controlled. But local authorities are seeking to require that this be lifted to 98.5 percent, which would gather in about 10.8 pounds per hour of dispersible emissions. This system will cost $5.3 million to install and require 3,500 horsepower of electrical energy to operate. It is calculated that the removal of these 10.8 pounds to meet visibility standards only could

result in 55 pounds of power plant emissions, mostly sulfur and nitrogen oxides and will needlessly consume 27 million BTUs of fuel per hour.

Not too long ago the chief of toxicology and pathology in the National Institute for Occupational Health and Safety (Dr. Herbert Stokinger) made a plea for "sanity in research and evaluation of environmental health". He gave numerous examples of unnecessary controls based on scare tactics. One of them was, in brief, the scare and costs and furor that evolved when it was discovered that a Nevada town's drinking water contained levels of arsenic in excess of .05 milligrams per liter - the "mandatory" limit set by the U. S. Public Health Service. Investigation showed that this was not contaminated water but was a natural arsenic level, that the people had been drinking it for over 28 years without any evidence of ill health or harm. The problem was, as he saw it, not with the water but with the standard; it should have been .2 milligrams per liter.

More recently, Dr. Stokinger pointed out the fallacy of over-reaction by saying:

> "...It is clear to us that you have fallen into the fallacious trap of believing that because the substance produced dire consequences at massive concentrations...such consequences will result from exposure at all concentrations. Wrong!"

John Maddox, one of England's leading scientists, who is editor of the world-respected Nature magazine and also a leading advocate for environmental improvement, expressed his concern over "...the danger that the extreme wing of the environmental movement may inhibit communities of all kinds from making the fullest use of the technical means which exist for the improvement of the human condition".

Maddox's book, The Doomsday Syndrome - which I strongly recommend you include in your readings - takes on fearlessly many of the erroneous and distorted claims of such as Dr. Barry Commoner of St. Louis and the late Rachel Carson of Silent Spring fame.

For example, of Commoner's exaggerations about dangers of carbon dioxide from power plants, Maddox says:

> "...volcanoes share with power stations the distinction of being important sources of carbon dioxide for the atmosphere. And the seas are continually robbing the atmosphere of carbon monoxide. To know just how to strike a balance between these two effects is difficult, but the prophecy of calamity requires that all the uncertainties in the calculations should conspire to the most gloomy end.... The best way to prevent accumulation of carbon dioxide in the atmosphere is not to build power stations.... Policies of doing nothing should seem easier than policies which require vigorous and expensive action, but widespread acceptance of what the doomsday men are asking for could so undermine the pattern of modern economic life as to create social stagnation."

Perhaps the latter comment by Maddox in 1972 was more prophetic than he intended. Are we currently in an economic and social stagnation period because of unsubstantiated claims of environmental disaster from our efforts to obtain energy, from the costly delays resulting in developing more energy, and from the even more costly regulations that are unneeded?

The current continuing dispute over mandated emission controls on power generating plant stacks versus other means of maintaining air quality is another example. Are we more interested in keeping chimneys clean and healthy, or in keeping the air clean and healthy for the people - and at the same time provide them more and less costly power. It has been estimated that present stack emission control requirements for the power industry - mainly scrubbers - would cost at least $5 billion in increased rates for consumers and would unnecessarily use the equivalent of about 600,000 barrels of oil daily now and about a million barrels daily by 1980. The alternative, it should be pointed out, is not worse ambient air, but different ways to achieve acceptable quality of the air. In some places scrubbers may be necessary - but not every place, as now demanded.

Someone remarked recently that with new scientific techniques at hand, we are able to learn less and less about more and more. What he meant was that we are able to detect the presence of more and more substances, but we do not know the meaning of this.

A good example may be the recent publicity given to the claim that cancer-causing substances were found in water in the New Orleans area. According to those who have studied the research on this, these substances were detectable only by running through filtration the amount of water it was estimated one man would drink over a 70-year lifetime - or 70,000 gallons. To get substances, therefore, a man would have to drink this 70,000 gallons at one sitting.

Much opposition to certain energy discovery and development activities are based on horror predictions similar to some of these examples. The exploration and recovery of petroleum from the outer continental shelf, for example, is constantly being challenged on grounds with little or no foundation. The experiences with the thousands of wells in the Gulf of Mexico have been, by and large, proof that petroleum recovery from the seas is possible without environmental disaster. Such events as the highly publicized Santa Barbara breakout of petroleum were highly costly and extremely inconvenient nuisances for both companies and people. But there was no catastrophe and the cleanup was accomplished in such a way as to leave the impacted areas better than they have ever been. Scientific studies done since in the area have produced no evidence of any real or lasting ecological damage. And yet emotions ran high because of pictures seen of dead seals soaked with oil - pictures that were later proved to be of sleeping seals slicked with ocean water.

A more educated and more objective examination is needed of those data and those pronouncements that are assembled to back up preconceived positions. To quote John Maddox again, scientists advocating extreme actions "...have too often made more of the facts than the conventions of their craft permit. Too often, they have expressed moderate or unsure conclusions in language designed to scare, sometimes with the open declaration that exaggeration is necessary to 'get things done', but with the result that other people have been alarmed and mystified, not enlightened".

Inasmuch as we are meeting at the mouth of the Mississippi River, I will give a final illustration by referring to an elegant discourse on this subject by Mark Twain in his <u>Life On The Mississippi</u>. Twain has just cited some of the meanderings of the Lower Mississippi that resulted in cutoffs - shortening the length of the river over the course of time. Twain writes:

"Now, if I wanted to be one of those ponderous scientific people, and 'let on' to prove what had occurred in the remote past by what had occurred in a given time in the recent past, or what will occur in the far future by what has occurred in late years, what an opportunity is here!"

"In the space of one hundred and seventy-six years, the Lower Mississippi has shortened itself two hundred and forty-two miles. That is an average of a trifle over one mile and a third per year. Therefore, any calm person, who is not blind or idiotic, can see that in the Old Oolitic Silurian Period, just a million years ago next November, the Lower Mississippi River was upward of one million three hundred thousand miles long, and stuck out over the Gulf of Mexico like a fishing-rod. And by the same token any person can see that seven hundred and forty-two years from now the Lower Mississippi will be only a mile and three-quarters long, and Cairo and New Orleans will have joined their streets together, and be plodding comfortably along under a single mayor and a mutual board of aldermen. There is something fascinating about science. One gets such wholesale returns of conjecture out of such a trifling investment of fact."

With that I shall conclude with the thought that environment and energy need not conflict -- and perhaps the twain can meet.